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SOME CASES OF CHRONIC ENTROPION AND TRICHIASIS OF THE UPPER LID, RESULTING FROM GRANULAR OPHTHALMIA.*

By G. HAY, M.D., Boston.

THIS affection presents itself very frequently at charitable Institutions for the treatment of eye-diseases, though comparatively seldom in private practice. Besides the disease of the conjunctiva, with its roughness and shrinking, there is also a slight incurving of the edge of the lid, and consequent change in the position of the lashes, which, instead of being directed forward, away from the cornea, come to rest upon or press against it; occasionally, also, the palpebral aperture is diminished. Moreover, owing to the mechanical irritation of the above-mentioned changes, and, perhaps, sometimes, to an extension of the conjunctival disease to the cornea, the latter often becomes vascular, turbid or opaque, and ulcerated.

The shrinking of the conjunctiva may, of course, be aggravated by excessive cauterization, and, as this is sometimes the case, it is better to err on the side of too mild applications, rather than of the opposite. The general opinion, however, is that a certain degree of shrinking of the conjunctiva and consequent incurving of the edge of the lid is due to the natural course of the disease, although, even on this point, a different opinion is held by Mannhardt,† who observed in the East very many cases of the injurious effect of bad treatment.

This combination of diseased changes, attended by more or less pain and discomfort and serious impairment of sight, is sometimes beyond the power of the medical man to cure. The active disease of the conjunctiva is often very difficult to control, and, even after the active inflammation is over, the shrunken and cicatrized condition in which the lining membrane of the lids may be left, is of itself, in many instances, a source of irritation, partly by impeding the motion of the eyeball, and partly by pressure upon it, and this altered conjunctiva cannot be restored to its normal state.

To give some relief under these circumstances by remedying, to a certain degree, the injurious condition of the edge of the lid, many operations have been proposed. In the first place, it may be stated that, in the cases we are here considering, cases of chronic entropion and trichiasis, resulting from granular ophthalmia, the excision of a piece of skin from the lid (in the case of the upper lid), while having but little effect to remedy the entropion, has an injurious effect by

* Read before the Boston Society for Medical Observation.

† Archiv für Ophthalmologie, xiv. 3, page 41.

shortening the lid. In case of the lower lid, where the tarsus is smaller, Walton's operation of removing a strip of skin and muscle next the edge is sometimes useful.

Until within a few years, I had generally preferred the removing of the cilia by Flarer's operation, by taking away from the edge of the lid its anterior layer containing the bulbs (this edge having previously been split into two layers, the anterior containing the bulbs). This operation often gives considerable relief, but is open to the objection that it is not directed principally against the incurving of the edge of the lid, that it is sometimes followed by an uneven cicatrix of this edge, and that it sacrifices the lashes.

Another operation is that known as Arlt's modification of Jaesche's operation. This involves removing a large piece of skin from the lid, which is objectionable as endangering the shortening of the lid, and also requires dividing the edge of the lid into an anterior and posterior layer, so that all the bulbs of the cilia may be contained in the anterior layer (which is to be transplanted upwards on the lid) and none in the posterior. Such a section is by no means easy to make when the disease is advanced, since then the cilia emerge close to the free edge of the inner surface of the lid, and we may easily leave some of the bulbs in the posterior layer of the divided lid-edge, or if the section is not smooth we may get subsequently an injurious cicatrix of the edge of the lid.

Graefe's modification of this, which consists in sliding up on the lid the anterior layer of the edge which contains the ciliary bulbs, without necessarily removing a piece of the skin, presents objections similar to those already mentioned.

Another operation, acting more directly to cure the incurving of the edge of the lid, and called "grooving the fibro-cartilage," was described by Mr. Streatfeild in 1858, in vol. i. of the Ophthalmic Hospital Reports. Ten years later, in 1868, a similar operation was strongly recommended by Mannhardt, in the *Archiv für Ophthalmologie*, vol. xiv., part 3, and there referred to as the operation of Snellen.

The essential feature of these operations appears to be the removing from the tarsus along its whole length a strip of its substance; the strip to be somewhat wedge-shaped, with its base towards the skin, and the opposite edge or apex towards the conjunctiva, so that when the walls of the gap (thus made throughout the length of the tarsus) grow together, the inverted edge of the lid may be drawn away from the eyeball. The strip of tarsus is removed through a cut in the skin, made along the edge of the lid, and distant about one or one and a half lines from it. The ciliary bulbs are to be avoided. It is desirable, also, to avoid incising the conjunctiva, and especially not to excise any of it.

According to Mannhardt, two or three sutures may be introduced, each passing, at the upper part, through the substance of the tarsus itself, at the lip of the groove, and below, not through the tarsal substance, but between this latter and the skin, the suture to emerge a little above the emergence of the cilia. In a recent description of Snellen's operation, in the *Annales d'Oculistique* for March and April, 1873, some minute directions are given for the sutures. But Streatfeild's method omits sutures. According to Streatfeild's method, the strip of skin and muscle corresponding to the excised wedge of tarsal substance may also be excised.

The following few notes of several cases treated at the Massachusetts Charitable Eye and Ear Infirmary, by a method similar to that of Snellen, have given me the impression that the method of excision of a strip of the tarsus is, in general, preferable to the removal of the lashes, or to Arlt's modification of Jaesche's operation. The notes are, unfortunately, too scanty to illustrate fully the advantage of the method, but they will show some of the accidents to which the operation is liable, and, as of use in this respect, I beg leave to offer them to the Society.

Case I.—A woman, American, aged 26, dressmaker, suffering from chronic entropion and trichiasis of both eyes, was admitted to the Infirmary 1872, Feb. 22. As she was quite averse to having the lashes removed, it was determined to try grooving the tarsus, by a method similar to that of Snellen; this was accordingly done February 27th, under ether, on the upper lid of the *right* eye.

One of the tarsal sutures was removed March 1st, and the other March 3d, and the patient was discharged March 6th, very much improved.

June 14th.—Grooving of the tarsus, as above, was done on the upper lid of the other eye, the left. Also, each lower lid operated on by removing a narrow strip of skin along its edge.

Aug. 24th.—Another secondary operation for trichiasis on the *left* eye, but the record does not state what. About a year later, 1873, Aug. 13th, a few incurved lashes removed from inner end of upper lid of one eye.

That this last operation should have been required is in accordance with the experience that it is more difficult to rectify the position of the lashes at the ends of a lid than of those at its middle. On the whole, the patient was improved by the numerous operations.

Case II., 1871, Sept. 30th.—Mr. ——, Armenian, aged about 26 years, consulted me for his eyes, both of which were affected with chronic, granular ophthalmia; there was also an ulcer of the left cornea. The patient was seen by me a few times at intervals till March 18, 1872, when the eyes were somewhat improved. After more than a year, he again called on me, 1873, May 28. The left eye showed decided distichiasis of cilia of upper lid, and some alteration in the tarsus. The right showed partial distichiasis.

1873, June 2.—Patient entered the Infirmary, and the next day each upper lid was operated on, under ether, by removing a narrow strip of tarsal substance lengthwise from the front of the tarsus along its whole length. The patient left the Infirmary June 9th. On June 20th, the middle third of the lashes of the upper lid of the right eye were wanting, and a somewhat similar appearance on the left.

Aug. 12th.—A few scattered lashes from the middle third of each upper lid scrape the cornea. These were drawn out.

1874, Feb. 10.—The right eye shows, at the middle of the edge of the upper lid, a few very fine cilia. The left has slight cloudiness and unevenness of surface of cornea. Conjunctivæ of upper lids high-colored and somewhat shrunken, more so in the left.

This case, in which I had decidedly advised the operation, was not altogether satisfactory, for, though in the main the position of the edges of the lids and of the cilia was improved, yet, in addition to losing certain of the cilia, the preservation of which I had expected,

there appeared some degenerated or dwarfed cilia, with faulty position. This was probably due, either to cutting directly into, or too near to some of the bulbs. At the same time, while bearing in mind the propriety of avoiding the roots of the lashes, it is also to be remembered that the nearer to them the lower incision into the tarsus is, the larger can be the strip of tarsus excised.

Case III., 1873, Aug. 7.—A woman, American, aged 62, was admitted to the Infirmary with incurving of the temporal half of each upper lid, and with some trichiasis.

Aug. 8th.—Under ether, after dividing the outer canthus, the operation of grooving the tarsus, by a method similar to that of Snellen, was undertaken on the *right* upper lid, but was found to be difficult, owing, perhaps, to the shrunken condition of the conjunctiva. This was accidentally incised, and, possibly, a small bit of it excised.

On account of the difficulty met with in doing the grooving of the tarsus on the right, it was thought better to try on the other eye, together with division of the external canthus, the removal from the edge of the lid by Flarer's operation of the anterior layer, containing the ciliary bulbs.

Aug. 9th.—The lid from which the lashes were removed is more swollen than the other.

Aug. 15th.—A short, narrow strip at the middle of the ciliary edge of the *right*, that on which the grooving was done, seems to have sloughed.

Aug. 19th.—The lashes of the temporal half of the upper lid of the right were turned outward by the operation, as desired, but a small portion at the middle of the upper lid-edge has sloughed, leaving a notch about 1½ lines deep, and 2 lines long.

In general, a small incision of the conjunctiva would not be injurious, and even the excision of a small bit, though to be avoided, as giving rise, subsequently, to a scar, which might irritate, yet would hardly interfere seriously with the healing. In the above case, one or more of the sutures may have been drawn too tightly, or the sloughing may have been due to the age of the patient.

Case IV., 1873, Aug. 18.—A woman, Irish, aged 30 years, had had, about six years ago, the lashes removed from each upper lid by Flarer's operation. The *right* eye had been relieved. The *left* was still troublesome, and shows some lashes still growing at the nasal half, and the temporal half of the tarsus is quite convex externally. The patient, complaining of suffering in this eye, is admitted to the Infirmary, and two days afterwards, in the hope of relieving the irritation, the remaining lashes of the left upper lid were removed, and a strip of tarsus was also excised lengthwise from the temporal half of the lid, in order to relieve the incurving of this part of the edge.

Aug. 22d.—Discharged, relieved.

The *left* eye, in this case, illustrates well the occasional unsatisfactory result of Flarer's operation for removal of the ciliary bulbs, although the other eye had been relieved by that operation.

Case V., 1873, Aug. 7.—A young man, aged 18, was admitted to the Infirmary with granular ophthalmia, incurved upper lids and some trichiasis. He remained under treatment for some time, and was again admitted Dec. 1st, for operation, which was done by grooving the tarsus of each upper lid by a method similar to that of Snellen, three sutures being inserted in each case.

Dec. 9th.—Swelling of lids less. Ecchymosis nearly or quite gone. Middle third of edge of right upper lid excoriated along the line of emergence of the lashes.

Dec. 13th.—Insufficient closure of lids of each eye, which, however, existed before the operation, according to the patient.

Dec. 23d.—Middle third of edge of right upper lid is without lashes. Patient thinks operation has helped him.

1874, Feb. 11.—Effect of operations on the position of the lashes is rather satisfactory, but conjunctival disease remains.

Case VI., 1874, Jan. 5.—A young man, aged 15 years, born in England, was admitted to the Infirmary with trichiasis, entropion and corneal opacity of the *right* eye, and nystagmus of both eyes.

Jan. 6th.—A strip of tarsal substance was removed from the tarsus of the the upper lid of the *right* eye; three tarsal sutures, and one to connect the flaps of skin, were applied.

Jan. 9th.—Discharged from the Infirmary, improved.

Feb. 24th.—Right eye much improved as regards entropion, but nystagmus remains. Patient thinks some improvement, also, in vision of *right*.

Case VII., 1874, Feb. 27.—A man, aged 31 years, born in Ireland, was admitted to the Infirmary. The *left* eye was lost from smallpox many years ago. The eyeball was atrophied, but without pain, spontaneous or on pressure. In the *right* eye, there was granular ophthalmia, with a slight incurving of the edge of the lid, and alteration of the corneal surface. The lashes had been pulled out at various times since last April. Now several small cilia turned towards the cornea.

Feb. 27th. A strip removed from the tarsus of the right upper lid; a thick, large strip from the temporal half, but not as large a piece from the nasal portion. This was perhaps due to the nasal end of the cutaneous incision being a little too far from the edge of the lid. At this end of the lid, the conjunctiva was accidentally incised.

March 1st.—Sutures removed.

March 14th.—Edge of lid well everted. Cornea improving.

March 15th.—Patient thinks he sees better than before the operation. Conjunctival disease remains, and may require further treatment.

PNEUMONIA; PLEURISY; PNEUMO-EMPYEMA. PERMANENT OPENING FOR FOUR MONTHS. RECOVERY.

By H. C. Marion, M.D., of Brighton.

M. S., strong, well developed, nineteen years old, fell sick with pneumonia of right lung, February, 1873, after exposure to cold. As resolution was being established, trouble in the left lung was announced by chill, increased febrile disturbance, with physical signs of pneumonia. The disease took on an asthenic form, and for eight or ten days his case looked very doubtful. In due time, however, convalescence was pronounced, but was interrupted in a few days by pleuritis of the right side. This was followed by effusion. As this condition caused no urgent symptoms, the line of dulness being an inch or more below the nipple when in an erect position, I depended on general treatment rather than direct interference. In April, he was out, and came to the office for advice. He im-

proved very slowly, if at all, on tonics, stimulants and generous diet. On this account, I suppose, I lost sight of him until June 14th. Under this date, I find in my note-book :—" Have lost sight of him (the patient) since the 1st of May. As he is now losing ground very rapidly, he comes to me, asking the very pertinent question, 'Is there nothing you can do for me? I am losing ground every day.' His general appearance is convincing proof of the last assertion.

" Examination of the chest, by inspection, shows unilateral respiration ; apex beat of heart at left of nipple-line ; percussion gives dulness over whole of right side as high as the nipple ; less marked above. Some dulness at the lower part of left chest posteriorly. Auscultation gave signs of bronchophony at upper part of right, absence of respiration below the line of dulness ; vocal fremitus marked above line of dulness ; vesicular murmur fair on the left side. Succussion sound is very marked. Causing him to stoop and rise quickly to erect position, my ear all the while on the chest, the peculiar *splashing* sound cannot be mistaken. Expectoration purulent and fœtid. Sitting bolt upright is the only position he has maintained for the past two weeks, day and night. No appetite ; frequent chills, with hectic and inability to get warm. Pulse 120. Temperature 103°. Indeed, he looks as if he must soon pay the debt of nature."

Satisfied of the presence of pus and air in the pleural cavity, I told him and his parents I could do nothing for him unless I opened the chest ; and, although that might not cure him, it would certainly relieve him. They consented. On the 15th of June, assisted by Drs. J. L. Hildreth and E. H. Stevens, who previously confirmed my diagnosis and seconded my desire to open the chest, I introduced a medium sized trocar between the eighth and ninth ribs directly below the angle of the scapula. No anæsthetic was used. Thirty-four ounces of pus escaped from the canula. I then introduced a probe through the canula, removed the canula, and passed a director on the probe. With a bistoury, I made an incision, about an inch and a half long, between the ribs. With a common Davidson's syringe, I injected water containing carbolic acid. This I continued to do daily for nearly two months, excepting for a few days, when Dr. Giddings kindly cared for my patient in my absence.

The immediate relief he experienced was very great. As he remarked the day following, the ease he got was worth the operation if he should not live twenty-four hours. He improved constantly, with but few remissions. The cavity, which held at first a little more than a quart, became gradually smaller. Cough and expectoration ceased almost at once ; night sweats, chills and hectic disappearing. Appetite returned, and he gained in weight rapidly, so that I noted, from July 1st to the 21st, he gained twenty-four pounds.

I tried various devices for drainage ; but the simplest method was by far the best, namely, a piece of linen introduced (which could be easily done with a probe and director), the outer extremity divided and made fast to either side of the opening with collodion.

July 25th, I noted a very strange occurrence, undoubtedly the result of pressure or irritation of the intercostal nerve. From my notes of that date :—" Tent came out during the night ; on introducing the tube (a female catheter, the extremity of the syringe being now too large), I found it necessary to break up recent adhesions ; this was done with no

unusual pain. The tube fitted so closely that the water did not return around the tube as usual when the cavity became full. After I had injected about half a pint, he asked me to stop, as it distressed him. Disconnecting the syringe, the tube slipped partly out. As I re-introduced it, he exclaimed, 'My right hand feels so queer.' He looked strangely; thinking him faint, I laid him back upon another chair, asking him how he felt. 'I can't tell how I feel. It is going all over me.' Every muscle in his body seemed to be relaxed, and he was perfectly unconscious. I felt hastily for the pulse, but did not detect it. We lifted him to the bed, and commenced vigorous friction over the body. Pulse could soon be felt at the wrist, and he was in a few minutes able to swallow stimulants. On examination, I found he had had an involuntary dejection. He felt strangely for several hours. In describing his sensation, he said:—'At first, it was very much like the sensation when one hits his 'crazy bone;' after that, I didn't know anything.' From the 1st of August until the 5th of November, I continued to wash out the chest every two, three or four days. After that, I allowed the opening to close, as nothing but serum escaped from the cavity."

Nearly all this time, he could with the greatest of ease extinguish a candle held to his side. He could also taste the carbolic acid injection, and would often spit the fluid from his mouth, showing the opening through the lungs to be patent.

Feb. 1874. Examination of the chest shows but little, if any, difference in its contour. Resonance good over both lungs. Respiratory murmur somewhat more feeble over right than left. He says he never felt better in his life than he does now.

STRANGULATED UMBILICAL HERNIA, WITH LOSS OF PORTION OF INTESTINE.—The patient was a woman, aged about 68 years, and, when first seen, was found bathed in a cold, clammy perspiration, with feeble pulse, vomiting fluids of a stercoraceous odor; all her symptoms, in short, pointing to impending collapse. Upon exposing the abdomen, an umbilical hernia was found, the size of a child's head, the integuments covering the tumor being highly inflamed, of a dark, livid color, and on the verge of giving way from excessive distention. Upon inquiry, it was ascertained that the hernia had existed for thirty years, and she had experienced frequent attacks similar to the present, which had always been relieved by fomentations. Strangulation had now occurred three days previous, and meanwhile no medical aid had been called, though her sufferings had been excessive. The operation for artificial anus presenting the only hope for relief, an opening was made through the integuments and tissues beneath, exposing the intestine, the walls of which immediately gave way from distention, giving exit to the feculent and gaseous contents of the loop. The incision in the integuments was then enlarged, exposing fully the interior of the tumor, which was found to be in a gangrenous condition, a well-defined line of demarcation appearing at the point of exit from the abdomen. This gangrenous loop was next separated and removed, and was found to be composed of *fourteen inches* of the transverse colon, with a large portion of omentum. The operation was followed by a rapid disappearance of all the distressing symptoms, and recovery rapidly ensued. At a subsequent date, the edges of the two ends of the colon were refreshed and approximated by means of wire sutures, the result of which was that a complete union was obtained, so that the entire contents of the colon again made their exit at the rectum. It is now over two years since the closure, and the woman is in perfect health, being able to do her own housework.—Dr. J. N. REEDER, in *The Chicago Medical Journal*, June, 1874.

Progress in Medicine.

REPORT ON SURGERY.

By J. Collins Warren, M.D.

[Concluded from page 599.]

The Elastic Ligature.—The elastic ligature has not met with such success in this country as its advocates possibly may have hoped for it. It is said to possess certain advantages, however, in the treatment of fistula in ano, particularly if the fistula is a long one. All danger of hæmorrhage is avoided, and the healing process goes on with rapidity after the ligature comes away, which event usually occurs at the end of about four days. The pain and inconvenience to the patient is slight, and no confinement to bed is required.

The mode of proceeding in the use of the elastic ligature is described by Prof. Dittel, in an article published by him in the *Allgemeine Wiener Medizinische Zeitung*, Feb. 25th and March 4th, and translated for the *London Medical Record*, December 3d, 1873. We give the following extract:—

"In nævus, after transfixing it with needles as for ordinary ligature, I have the tumor fixed by an assistant during the tying. A single, circular ligature is sufficient. In the two cases in which I used this treatment, the nævus fell off in eight days.

"In fistula ani or sinuses about the rectum, the elastic ligature has especial advantages where the inner opening of the fistula lies high up or the sinus extends far. In the case of sinus, an inner opening (into the rectum) is first made by means of a trocar. The trocar being withdrawn, the elastic thread is introduced through the canula and drawn out through the rectum. This proceeding is rendered more easy by first introducing a metallic thread into the rectum through the canula, seizing it with the finger or forceps, drawing it through the anus, and removing the canula. The outer end of the wire is now fastened to the small elastic tubing by means of a waxed thread. In this way the elastic cord is very easily drawn through, if the index finger of the left hand can be passed up the rectum as far as the opening. Both ends of the ligature are drawn upon, and tied rather tight. The bridge of intestine with the sphincter is generally cut through in three or four days, and the patient finds the ligature, contracted into a ring, lying in his bed. In complete fistula ani, the metal wire is carried into the intestine along the groove of a director, and the use of the trocar is unnecessary.

"In prolapsus ani, the protruding fold is seized with hooks or polypus-forceps, as for the application of the ordinary ligature, and drawn down a little. In order that the fold may not escape from the forceps while the ligature is being applied, an assistant must press against the fold after it is seized, a second must stretch the cord, and a third must fix between his fingers a small portion of the cord corresponding to the fold, so that it remains only for the operator to tie the ligature. The ligature falls off in three or four days.

"In tumors, the elastic ligature has its application when they are pedunculated, or when they can be isolated, or when it is not possible

or necessary to save the skin. It is thus inapplicable in diffuse infiltration. I have had only one opportunity of applying the elastic ligature to a tumor. The patient was Frau H., aged 74, and at her age neither I nor another surgeon would have undertaken the risk of a bloody operation. But, having already ascertained that the elastic ligature did not produce any fever, and as the old lady earnestly desired that the tumor—a fibrous cancer of the right breast—should be removed, I concluded to make this first attempt. The cancer had at its base a vertical diameter of about four inches, and a transverse diameter of five inches, and was movable. I passed a Fleurand's trocar through, beneath the tumor, in the direction of the vertical diameter; and, having withdrawn the trocar, I introduced through the canula two waxed threads, and by means of them drew through two pieces of small India-rubber tubing; the canula was then withdrawn, leaving the tubes. I now, while an assistant drew forward the tumor, embraced each half in the corresponding portion of tube, and tied the ends of the tubing firmly in a double knot. This was done in the outpatient department, on January 9, 1873. On the second day, I had the patient taken into ward No. 81, as she was rather anxious on account of some pain. The furrow produced by the ligature became deeper daily before our eyes, leaving a granulating surface, while the tumor correspondingly collapsed, sloughed, and fell on the tenth day. During the whole time, the patient had no fever, only an increase of thirst on the eighth day. The old lady was right well pleased with the result.

"I have applied the elastic ligature to arteries in the following cases:

"*a.* To the popliteal artery, on the occasion of amputating the left thigh after Gritti's method. The ligature was thrown off on the sixteenth day.

"*b.* To the anterior tibial artery in two cases of amputation of the left leg, the ligature falling off on the seventh day; and once in a Pirogoff's amputation.

"*c.* To small branches of the anterior and posterior tibial and peroneal arteries."

The writer does not seem to have had much success in the application of the ligature to arteries.

Resection of the Elbow-joint.—Hueter. (*Jahresbericht*, 1872, Band ii., abtheilung ii.) The peculiarity of Hueter's method consists in making two lateral incisions, one over the internal and one over the external condyle. A longitudinal incision, from one to two centimetres in length, is first made over the internal condyle and a little nearer the volar than dorsal aspect of the joint, in order to avoid the ulnar nerve. The condyle is then freed from the muscles inserted into it, and also from the internal lateral ligament. A second incision, made over the external condyle and head of radius, opens the joint. The head of the radius is turned out and sawn off. The left forefinger is next inserted through the space thus made underneath the anterior portion of the capsule, which is made tense, and its insertion into the anterior aspect of the humerus is divided with a knife; or, if it is necessary to resect a portion of the shaft of the humerus, the capsule and periosteum are lifted off the bone by a periosteum elevator. The forefinger is then introduced beneath the posterior portion of the capsule, which is separated from the bone in the same manner. The elevator should always

be used in raising the ulnar nerve from the bone. The end of the humerus is now pried out through the radial incision, which movement generally ruptures the portions of the capsule still adherent to the bone, and also any fibres of the internal lateral ligament which have remained uncut. The bone is sawn off with a bowshaped saw. The tendon of the triceps is next separated from the olecranon with knife and elevator, and the coronoid process is freed in the same way. Sawing off the articular end of the ulna completes the resection. A silver drainage tube is inserted into each incision, and the arm is put in a plaster bandage, in which openings are left on the inner and outer side of the joint. The advantages claimed for this method are that the tendon of the triceps remains uninjured, and its connections with the periosteum of the ulna and the fascia anti-brachii are maintained. The operation also facilitates the subperiosteal resection of the joint. Heuter has performed this resection, with gratifying results, in seven cases.

The Application of Esmarch's Bloodless Method to Amputation at the Hip-joint.—(Prof. Volkmann, *Centralblatt für Chirurgie*, No. 5, 1874; *Allgemeine Medizinische Central-Zeitung*, May 9, 1874.)—The author of this article gives three cases of amputation at the hip-joint, in which he has employed Esmarch's method, which, he thinks, can be adopted with complete success (?) in this operation. The limb having been bandaged up to the groin, the India-rubber tubing is applied on a line starting from the femoro-scrotal commissure and directed obliquely outwards, running parallel to Poupart's ligament. The tubing should be firmly held in place during the operation, either by the hands of assistants or by means of three loops of bandage, which should pull it upwards and prevent its slipping forward over the muscles which have been cut through and have retracted. In all three cases, skin flaps were made, the muscles divided by a circular cut three fingers' breadth below the groin, and the bone was sawn through at this point. All vessels that could be seen were then tied, and the remainder secured while the tubing was very gradually loosened. Finally, the remaining portion of the bone was laid bare by peeling off the periosteum, and the head of the bone was removed from the socket.

The first case was that of a very anæmic boy with hip-joint disease, which had gone too far to admit of resection. Less than one ounce of blood was lost. The femur separated readily from the inflamed periosteum on very slight traction.

The second case was a very large and muscular man, whose leg and thigh had been mangled in a railroad accident. Loss of blood, less than three ounces. Death from shock.

The third case was that of a man with a suppurating and bleeding myxo-fibroma. On the application of the bandage, there was a brisk hæmorrhage from the ulcerated portions of the tumor, and although this was speedily checked by the application of compresses, about three ounces of blood were lost. Two ounces more were lost during the operation. According to the writer, death from chronic chloroform poisoning occurred four hours after the operation.

Subcutaneous Injection of Carbolic Acid.—Dr. Hueter recommends the subcutaneous injection of carbolic acid as a remedy in certain local affections (*Centralblatt für die Medicinischen Wissenchaften*, Jan. 24; *British Medical Journal*, Feb. 14). The danger of poisoning is

very slight, for, when given in this way, most if not all of the acid is absorbed by the lymphatics, and only small portions gradually enter the circulation. He uses a solution of two parts of carbolic acid in one hundred of water. This is injected by means of a subcutaneous syringe which holds about three-tenths of a grain of carbolic acid. The injection of two syringefuls of the solution at the same time has not been found to produce any symptoms of poisoning, nor has any darkening of the color of the urine been observed. This dose has not been exceeded at one injection, and the operation is repeated, if necessary, only after an interval of one or two days. No pain or swelling follows.

The antiphlogistic action was well marked in nearly all cases. It is, he thinks, one of the most powerful antiphlogistic remedies which we possess.

In white swelling of the knee, the injections are made at the most central part of the joint, so that the needle touches its surfaces. The result is abatement of the pain, falling of the evening temperature—which had been persistently high—and reduction of the swelling. The injections must be repeated at intervals of two or three days, according to the chronicity of the disease.

In subacute glandular swellings having a tendency to suppuration, and in inguinal and femoral buboes, the injection leads to abatement of the pain, redness and œdema, while the glands become reduced in bulk. The injections must generally be repeated several times.

In acute phlegmon of the subcutaneous and subfascial connective tissue, the injection is made at the periphery, as it may be calculated that the lymphatics will carry the remedy towards the centre. The result is to produce contraction of the tissue in a few hours, with cessation of the pain. Recovery takes place without suppuration, even if this, though imminent, has not already appeared.

In traumatic erysipelas, he makes an injection at different points along the edge.

Dr. Hueter states that the acid should be so injected as to be carried into the cavities of the largest joints, into the connective tissue surrounding the vessels, and into the interior of the lymphatic glands, and there exert its antiphlogistic influence.

He thinks this form of treatment may be adapted to diseases of the internal organs.

He cautions against the use of carbolic acid injections into any vascular tissues and tumors, as poisoning may be very easily produced.

Malum Perforans Pedis.—(Duplay and Morat. *Archives Générales*, May, 1873; *Schmidt's Jahrbucher*, Band 160, Heft 3.)—The authors have confined themselves to a study of some of the clinical symptoms and to the anatomical changes occurring in this disease, chiefly with a view to throw light upon the cause of the disease. Among the former, may be noticed the loss of sensibility in and around the ulcer, the paralysis of certain muscles and secondary inflammation which accompany the disease, and among the latter the changes in the nerves.

They thus formulate their views :—

1. The disease is an ulceration of the foot, which is accompanied by a degeneration of the nerves of this region.

2. The degeneration of the nerves, which is a cause of the ulceration, can arise from various causes : disease of the spinal cord, of the

ganglia, division or compression of the nerve trunks, alteration of the peripheral nerves.

3. As soon as the ulcer makes its appearance, the surrounding tissues undergo inflammatory changes. These changes may extend to a great distance from the original seat of the disease.

Necrosis.—Professor Heincke, in No. 63 of *Volkmann's Sammlung Klinischer Vorträge*, gives an account of necrosis of bone. "The proper time for the surgical removal of a sequestrum," he says, "lies between the period of the complete detachment of the same from the living bone and that at which serious affections, such as Bright's disease and lardaceous degeneration of the abdominal viscera, make their appearance. The separation of a sequestrum from the living portions of bone does not, according to general experience, take a longer period than six months; hence the practical rule that, even in cases where the sequestrum is not movable, an attempt should be made to extract it if the necrosis commenced at least six months before. The author recommends that, where the sequestral capsule or case of new bone is very thick and its cavity very large, the whole of one wall of this capsule be removed. By this proceeding, the healing of the wound after extraction of the sequestrum is much accelerated."

An abstract of this lecture may be found in the *London Medical Record*, February 4, 1874.

Sugar Coated Quinia Pills.—Dr. A. B. Lyons, of Detroit, has recently made an analysis *(American Journal of Pharmacy)* of different samples of sugar-coated pills, with the object of determining whether there was contained in them the full amount of quinia announced on the labels, and also to ascertain to what extent other alkaloids are substituted for quinia. The results of his experiments are given in the following table, the pills, obtained from five prominent manufacturing houses, being designated by numbers. We are are at a loss to determine why he has failed to disclose the names of the different manufacturers. Physicians will be reluctant to trust to the uncertain effects of fraudulently prepared drugs, and unless the names of the delinquents are made known, the result of these analyses will incline them to reject all quinia pills whatsoever issued in this form.

	Gross weight of 2-grain pill.	Alkaloids soluble in ether from five 2-grains pills.	Sulphate of quinia from five 2-grain pills.	One 2-grain pill crystallizes from water.
No. 1	4.8 grs.	7.15 grs.	9.55 grs.	5.5 drachms.
2	4.7 grs.	7.1 grs.	9.5 grs.	5.5 "
3	3.8 grs.	5.55 grs	7.4 grs.	1 "
4	3.7 grs.	4.65 grs.	6.2 grs.	3 "
5	4	5.7 grs.	4.3 grs.	2.5 "

The following simple test is recommended for estimating approximately the quantity of quinine contained in a pill, and is so simple as to be capable of being applied by those who make no pretensions to skill in chemical manipulation.

"Dissolve a two-grain pill in a fluid-drachm of water, by boiling it in a test tube. On cooling, the fluid should be set into a dense network of fibrous crystals. Add a fluid-drachm of water, or a larger quantity, if the first crystallization has been satisfactory, and heat till the crystals re-dissolve. In this way, proceed until crystals form in the solution only sparingly after cooling. The volume of fluid, in drachms, multiplied by 100, and divided by 6, will give now, approximately, the percentage amount of true quinine in the pill."

Bibliographical Notices.

An Introduction to Physical Measurements. With an Appendix on Absolute Electrical Measurements. By Dr. F. KOHLRAUSCH. New York: D. Appleton & Co.

Elements of Physical Manipulation. By Prof. E. C. PICKERING. Boston: printed for the Author. 1873.

THE work of Dr. Kohlrausch, which is entitled *Leitfaden der Praktischen Physik*, has been much improved by Mr. Waller and Mr. H. R. Proctor, who edit the English edition. The subject of electrical measurements is peculiarly well adapted for practice in manipulation by students. Dr. Kohlrausch did not treat the subject fully in his work. The English translators have added valuable chapters on this branch of physics. The tables of physical constants appended to the German edition were very meagre. The English translation contains valuable additions in this respect also. The aim of the book is evidently to aid teachers and a select class of advanced students who may be pursuing their studies in physical laboratories. A German professor evidently would not consider it possible to provide work for a large class of mixed students in a physical laboratory. Such laboratories have long existed in Germany; but the number of students studying in them has always been limited, never more than six or eight, and these students have generally been picked men. To such students, this work of Dr. Kohlrausch cannot but be very valuable. It contains methods of estimating errors of observations, determination of empirical constants, calculation of corrections and rules for numerical calculations. The experiments under the various heads of mechanics, heat, light and electricity, contain general discussions of methods of work, without, in general, their application to special pieces of apparatus.

Prof. Pickering's work, on the other hand, is adapted for students of a somewhat lower grade, in a laboratory fitted up to accommodate a large number of students, according to American ideas. The experiments are so selected that the teacher of a high school would find no difficulty in starting a class in physical manipulation. Much thought has been expended on the simplification and invention of suitable pieces of apparatus to put in the hands of students. In this respect, it differs largely from the work of Dr. Kohlrausch. A teacher would find it difficult to establish a laboratory on the basis of Dr. Kohlrausch's book for a class of American students, but no difficulty would be found in doing this with the aid of Prof. Pickering's work.

The chapter on general methods of investigation, in the last-mentioned work, contains much new matter, especially in the matter of graphical methods. The importance of representing physical laws by curves is insisted upon throughout; and in this respect the work differs also from Dr. Kohlrausch's book. The article on the graphical method is condensed from a valuable paper published by the author in the *Journal of the Franklin Institute*, lxi., 272. There are many novelties in this book; for instance, the apparatus for ruling scales (page 59), the photometers (pages 132 and 134), and the polarimeter (page 221). Another volume, on Heat and Electricity, with tables and lists of books of reference, is promised by the author, and will be looked for with great interest. The authors of these two books can congratulate themselves on having given an impetus to the only rational way of studying physics. J. T.

Transactions of the Michigan State Medical Society, for the Year 1873. Lansing. 1873. 8vo. Pp. 170.

THE seventh annual meeting of the State Medical Society of Michigan was convened at Saginaw, June 11, 1873, and the published account of the proceedings affords satisfactory evidence that the Society is in a highly flourishing condition. The annual address was delivered by the President, Dr.

A. B. Palmer, his subject being "Law and Intelligence in Nature; and the Improvement of the Race in accordance with Law."

We append the titles of the papers published in the proceedings; the papers relating to the matter of school hygiene contain many important suggestions upon a topic to which the laity as well as the medical profession are just now having their attention especially directed.

1. The Laws of Hygiene, in their relation to the Government of Schools, as affecting the Development of Children, Physically, Mentally and Morally. By H. O. Hitchcock, M.D.

In this paper, Dr. Hitchcock discusses some of the questions relating to the government and *régime* of schools. As to the age at which young children should be first sent to school, he considers that, for children under six years, a single session of two hours should be deemed sufficient for the day, or else two sessions of one hour and a half each. To schools constituted and conducted, however, like the kindergarten schools, where the instruction is of a nature to afford real amusement to the pupils, children as young even as three years may be properly and profitably sent. But, when we consider the unattractive manner in which the majority of our primary schools are conducted, it is not advisable to require the attendance of our children at an earlier age than six to eight years. The detention of a pupil after a lengthy session, as a means of punishment, is denounced as a striking infringement of the laws of hygiene, as shown by the circumstance that quite a number of boys and girls have been known to return home after such detention with their clothing soiled from over distention of the rectum and bladder, while in other instances headache and loss of appetite were reported. Other children experienced so great a degree of nervous agitation from the dread of after-school detention, that recitation became almost impossible. Cases are referred to in which this excessive nervousness culminated in either epilepsy or chorea. Dr. Hitchcock maintains, in conclusion, that our school system should be so reformed as to avoid the charge of being in a great measure responsible for the degeneracy of the American people. It should be made to conform to the exacting laws of hygiene, so as to contribute to the highest and most perfect development of children, both physical and mental. To attain this desired result, it is first of all important that the teachers should be educated with regard to the laws of physiology in their relation to the physical requirements of the young.

2. Hygiene, as applied to the Construction, Warming, Ventilation and Sewerage of School Buildings. By H. C. Kedzie, M.D.

This paper exposes some of the errors of our school system, and is all the more valuable from the circumstance that it embodies the results of extensive original investigations. The writer animadverts severely upon the erection of lofty structures for school purposes, and introduces testimony to show that excessive stair climbing may be productive of very injurious effects, more especially in those young girls in whom the menstrual function has been recently established. He expresses the conviction that school buildings should not exceed two stories in height. In cases, however, where necessity compels the use of these objectionable high structures, much evil can be averted by assigning girls between the ages of 11 and 17 to the first and second floors. The different methods of heating and ventilating schoolhouses are detailed at length; the method of analyzing air is explained, and, finally, the results of the inspection of a large number of schools is given.

3. Ethics. Shall the Medical Profession, or the Medical Schools, control Admission to the Ranks of the Profession?

This is the report of a committee, advocating a higher grade of medical culture, and maintaining that the profession itself, apart from the medical schools, should exercise a visible censorship and control over all admissions to its ranks, whereby the final decision as to a man's fitness to practise medicine shall be lodged with a power that does not find a pecuniary reward in granting diplomas to the unworthy.

4. Report of the Committee on the Medical Department of the University.

5. Coccyodynia. By Edward W. Jenks, M.D.

This affection is shown to be due to the action of the muscles attached to the coccyx. It is peculiar to women, because in females there is a greater development of the gluteal and other muscles attached to the coccyx, this development being a necessary consequence of the greater size of the female pelvis.

6. Otitis Media. By Eugene Smith, M.D.

7. A Case of Dislocation of the Spine, with Fracture of the Ribs. By L. W. Bliss, M.D.

8. Embolism of the Central Artery of the Eye; a Cause of not unfrequent Attacks of Sudden Blindness, with illustrative Cases. By Prof. J. F. Noyes.

Medical Society of New Jersey; Transactions. 1873. Newark: 8vo., pp. 224.

We learn from this report that the one hundred and seventh annual meeting of this State Society was held at Mt. Holley, May 27, 1873. After the opening address by the President, Dr. F. Gauntt, an essay was read by W. O'Gorman, M.D., his subject being "A Speculation on the Operative Treatment of Non-traumatic Peritonitis." This paper contains an able argument in favor of the operation of abdominal section, as a last resort, in the treatment of certain forms of peritonitis, more especially those cases, both acute and chronic, in which there are decided evidences of effusion. The operation would be likewise justifiable, he thinks, in cases of peritonitis resulting from perforation of the intestine, for, by this means, the irritating substance may admit of removal, while, at the same time. the subsequent discharge into the peritoneal cavity may be arrested. It is maintained by the writer that to open the abdominal walls in these lesions is simply carrying out to its legitimate end a common principle of surgery, imitating the course laid out by nature in instances of spontaneous opening.

In a paper entitled "Nervous Disorders of Women," T. H. Studdiford, M.D., gives, at considerable length, his views upon the etiology and pathology of hysteria, myalgia and cephalalgia. With regard to the origin of the phenomena characteristic of hysteria, he dissents from the views of the earlier pathologists in referring the originating cause of the malady to some derangement of the uterine, or reproductive system. He inclines, on this point, to the views of Dr. Tilt, maintaining that the predisposing conditions are to be found in the nervous system. He admits, however, that an eccentric cause may at times be found in some ovario-uterine, or other visceral disturbance. Myalgic pains are to be regarded, according to Dr. Studdiford, not as symptomatic of spinal irritability, but rather of muscular and nervous derangement, indicating a want of relationship between the muscles and the nerves supplying them. The disease may also be dependent upon some lesion of the nerve centres, and thus derive its origin from the enervating influence of disease and fatigue.

Ezra M. Hunt, M.D., in a paper upon "Professional Ethics," considers, at length, four special questions pertaining to ethics, as follows :—

1. What is the duty of regular physicians as regards medical societies?

2. What is our duty to physicians of different faith and practice from us?

3. What are our privileges as to advertising, or in general as to the management of our profession as a business?

4. What is our right relation to patent medicines, or instruments, and to dealers in, or venders of the same?

The views expressed by this writer are, on the whole, so sensible that we are the more surprised to come across the following statement as to the propriety of advertising.

"We have never seen a reason why a physician, settling in a place, should not issue a modest card or circular, or newspaper notice, stating his time and place of graduation, and, if he choose, giving the names of two or three physicians to whom he may refer. Such a course is neither boastful nor intrusive, and so far from being an injury would help to draw a real line between those who come without right qualification and those duly authenti-

cated, and the public would learn better to distinguish between regular and irregular practitioners."

That a young physician may, by keeping his name prominent before the public eye, obtain, within a short time, the favor and patronage of the community is a fallacy that has been repeatedly exposed, and finds now but few advocates. The process of securing the confidence of the public, without which the benign vocation of the physician cannot be exercised, must, from the very nature of the case, be a slow and gradual one. There are, it is true, certain means of attracting patients by a liberal display of newspaper notices and testimonials, but custom has assigned to the quack this method of presenting one's claims. Whatever estimate the young physician may form of his own abilities and attainments, he cannot expect the community to view them in the same light, until he has given evidence of his ability before some competent tribunal. Such a tribunal is afforded by society meetings and medical periodicals. To these, therefore, let the aspirant for medical honors make his appeal, rather than to the general public. Professional advertising has, in this section of the country, at least, fallen under condemnation, as tending to give rise to petty jealousies and local rivalries, and in this way lowering the character of the profession with the public.

In the appendix of this report are contained a collection of clinical cases of more than ordinary interest.

Lectures on Bright's Disease, with especial reference to Pathology, Diagnosis and Treatment. By GEORGE JOHNSON, M.D., F.R.S., &c. New York: G. P. Putnam's Sons. 16mo. Pp. 152.

THESE lectures are reprinted from the *British Medical Journal*, and are intended mainly for the use of students of medicine, though they will be found both interesting and valuable to the practitioner. They are quite elementary in their character, being devoted chiefly to the clinical history of the various affections which are commonly included under the head of Bright's disease. A sketch of the anatomy and physiology of the kidney (chiefly after Bowman), of the modes of testing the urine for albumen, and its microscopical investigation, and some general propositions relating to Bright's disease, are the subjects of the first lecture, which is followed by four others, on acute Bright's disease, the small granular kidney, the large white kidney, and the waxy kidney, respectively. The last two lectures are devoted to the subject of albuminuria not associated with Bright's disease, and to the treatment of acute and chronic Bright's disease.

Dr. Johnson's reputation as an investigator of Bright's disease makes everything written by him on the subject of interest. As containing good clinical descriptions of the various forms of Bright's disease, with judicious remarks on their treatment, contained within a small compass, we can recommend the book to those who have not the time or the patience to undertake more elaborate treatises. In accordance with the plan of the work, the subject of the pathology of Bright's disease is very briefly discussed; but enough is said to show that Dr. Johnson's views are not in accordance with the results of the best and most recent investigations in renal pathology, and this constitutes a defect in the work.

BOOKS AND PAMPHLETS RECEIVED.

A New Apparatus for Extensor Paralysis. By John Van Bibber, M.D. (From *New York Medical Journal.*) 1874. Pp. 6.

Report of Cases treated by Electricity. (From the *Transactions of the Medical and Chirurgical Faculty of Maryland.)* By John J. Caldwell, M.D. 1873. Pp. 21.

Electrolysis in the Treatment of Stricture of the Urethra. By Robert Newman, M.D. (Re-printed from *Archives of Electrology and Neurology.)* New York. 1874. Pp. 32.

Boston Medical and Surgical Journal.

BOSTON: THURSDAY, JUNE 25, 1874.

NOT only the profession but all the inhabitants of Massachusetts have lost a friend and a benefactor by the death of Dr. GEORGE DERBY. He expired in the first hour of June 20th, after an obscure and most painful illness of about a month's duration. The autopsy revealed abscesses in the liver, and peritonitis. Dr. Derby was born in Salem, in 1819; he was in the class of 1838, and took his degree in medicine at Harvard in 1843. Early in the war, he went into the field as Surgeon of the 23d Regiment of Massachusetts Infantry, in which, and other medical positions, he served with distinction till the end. On his return to Boston, he resumed the practice of his profession, and was appointed Surgeon to the City Hospital; but his tastes led him to sanitary studies, and in 1866 he began to edit the Registration Reports of Massachusetts, and continued to do so till his death. He took an active part in the establishment of the State Board of Health, which was happily accomplished in 1869, and he has held, from the beginning, the laborious office of Secretary, which made him the executive officer. It is by his labors in this position that he has laid this community under such deep obligation to him; but his influence has extended far beyond the State, and the effects of the impetus which he gave to sanitary science have been felt throughout the country. He was an enthusiastic reformer, but his enthusiasm was always under the control of his reason and of his conscience. He accepted the great responsibilities which often fell upon him, and, though courteous, he was firm as adamant. He made no display, but did his work quietly, patiently, thoroughly. He was Professor of Hygiene at Harvard University, and wrote the reports on that subject for this JOURNAL. There can be no doubt that his labors hastened his death, which leaves a void that cannot be filled. His family and friends have the satisfaction of knowing that his worth is acknowledged, and that the whole community joins them in deploring their loss.

THE new rooms of the Portland School for Medical Instruction were opened with appropriate exercises on the evening of June 17th. We are happy to see the revival of this excellent institution, which was founded in 1856, and did good service till its temporary closure, a year or two ago. It is not, strictly speaking, a medical school, as it has no authority to confer degrees, and it is for this very reason the more deserving of encouragement. There are many small colleges

which we wish could be changed into schools of instruction; places where the student seeks learning, not "cramming," or, indeed, a degree, without either one or the other of these preliminaries. There is great need of such an institution in Maine, for, though the course of the Medical Department of Bowdoin is necessarily short, embracing only four months, the Faculty has shown clearly, by rejecting nearly one quarter of the applicants, that degrees are for only the deserving. Now the two terms of the Portland School are arranged to fill up the remainder of the year, and offer far greater advantages than can be obtained by a course of reading, too often merely nominal, in the office of a country practitioner. The corps of instructors is strong and the fees small. At the opening, Dr. Dana delivered a very interesting, historical address, tracing the career of the school, and bearing testimony to the merits of the instructors.

The Hospitals.

MASSACHUSETTS GENERAL HOSPITAL.

(Tuesday and Saturday, June 2 and 6, 1874.)

OPERATIONS were performed in the following cases:—Deformity of Hip, Vesical Calculus, Cancer of Breast, Vesical Calculus, Gangrene of Foot, Cancer of Lip, Tumor of Jaw, Stricture of Urethra, Necrosis of Jaw, Double Hare-lip, Ranula, Lupus of Nose and Face, Fistula of Buttock, Epulis. During the week, Stricture of Urethra, Inguinal Hernia, Stricture of Urethra, one *séance* of Lithotrity in a case of Vesical Calculus.

Deformity of Hip—in a boy twelve years old, following hip disease. The thigh was flexed and adducted to a degree rendering necessary either the use of crutches or a decided stoop of the whole body at every step in walking. Tenotomy of the tensor vaginæ femoris, the rectus femoris and the adductor longus at their origins was performed; the thigh was then extended and bandaged to a straight splint.

Vesical Calculus—in a boy nine years old, who had always lived in Boston, The symptoms had existed two years. Lithotomy by the lateral method. The stone was flat and oval in shape; weight 307 grains, and measured one and five-eighths by one and one-fourth inches.

Cancer of Breast—in a woman fifty-four years old. It first appeared five months ago; had recently become quite painful; was of the size of a hen's egg, and located in the centre of breast. Excised.

Vesical Calculus—in a boy four years old, who had always lived in Boston. Symptoms for six months. Supra-pubic pain, and bloody urine; he had a long prepuce, which he was constantly pulling. Lithotomy by the lateral method. The stone was a flat oval, and weighed 38 grains.

Gangrene of Foot—senile, in a man of sixty-six years; it had involved the distal third of the foot, and the line of demarkation was well defined. Hey's amputation was performed.

Cancer of Lip—in a man sixty-five years old. The disease first made its appearance three years ago; since then, it had become a painful, ulcerating mass, involving one half the lip, and extending downward to the chin. The growth was excised, and the cheek and lip bordering on the line of incision dissected up to permit approximation of the raw surfaces; the wound was closed by silk sutures.

Tumor of Jaw.—An ulcerating, painful tumor of the size of a pigeon's egg, located near the first molar tooth on the alveolar process of the upper jaw, in

a woman, sixty-five years old. It had grown rapidly during the past two weeks. Three teeth were extracted and the growth excised.

Stricture of Urethra—in a man, forty-five years old. It was of gonorrhœal origin, and had existed fourteen years. He had been once relieved by internal urethrotomy. Retention occurred two days before he entered the hospital, and unsuccessful attempts had been made to enter the bladder by the urethra. Under ether, the stricture was found very tight, and would not admit a flexible bougie. The metallic guide of Voillemier's divulsor was passed, and the stricture ruptured with the large tube. A No. 12 elastic catheter was then passed into the bladder and left.

Necrosis of Lower Jaw—in a boy, seven years old, following an abscess caused by a carious tooth. About one half of the ramus of the left side was removed through the mouth, after enlarging the fistulous openings.

Double Hare-lip—in a baby four months old; one side had already been operated on successfully at the hospital. The second fissure did not extend into the nostril. The lip was transfixed just above its border on both sides of the notch, and the incisions carried upwards till they met. The strip thus partially detached was drawn downward, making the wound lozenge-shaped, and forming what has been called a living suture. The fresh borders were then accurately adjusted by fine, silk sutures.

Ranula—in a girl, eleven years old. The cyst was opened, the fluid evacuated, and the interior cauterized with nitrate of silver.

Lupus of Nose and Face—in a man of forty-six years. The disease was at first confined to the side of the nose, and consisted of an ulceration extending from the ala to the bridge, and at one point had opened into the nasal fossa. This had been treated successfully by the galvanic cautery, and is now cicatrized. Recently, a tumor, of the size of a filbert, had appeared under the healthy integument of the cheek, and half an inch below the border of the orbit. An incision was made through the skin, the growth exposed and dissected out; the galvanic cautery was then applied deeply to all the tissues in the vicinity of the disease.

Fistulæ of Buttock—in a middle-aged man, communicating with a sinus four inches long, located in the middle and posterior portion of the thigh; also with a sinus extending upward by the side of the rectum, but not opening into it. Laid open.

Epulis—recurrent, in a woman twenty-two years old. The growth was of the size of a filbert, and located near the last molar tooth. Encircled by an incision, and removed by bone forceps.

Stricture of Urethra—of gonorrhœal origin, in a man forty-one years old. Two years since, perineal section was performed, and had afforded relief until a month ago; since then, more or less difficulty in passing water. On entrance, a filiform bougie would not enter the stricture. Perineal section was performed, the stricture divided and a large elastic catheter passed into the bladder and left.

Inguinal Hernia—in a man thirty-three years old. Symptoms of strangulation had existed thirty-six hours, and unsuccessful attempts to reduce it while under the influence of chloroform had been made before he entered the hospital. He was etherized, suspended by the heels, and the hernia reduced by taxis.

Stricture of Urethra—in a man forty-seven years of age. Five years ago, a perineal abscess opened spontaneously; from that time urine has passed only through the fistulæ which followed. The integument and cellular tissue of the perineum were indurated, and infiltrated with urine and pus. Patient entered the hospital with retention, and the urethra would not admit a filiform bougie. Free incision in the perineum relieved the retention, but no trace of the urethra could be detected, on account of the cicatrices and extensive infiltration.

(Wednesday and Saturday, June 10 *and* 13, 1874.)

Operations were performed in the following cases:—Chronic Mammary Tumor, Caries of Femur, Hæmorrhoids, Epulis, Thyroid Tumor, Submaxil-

lary Tumor, Erectile Tumor of Lip, Stricture of Urethra, Abdominal Abscess. During the week, Extrophy of the Bladder, Harelip.

Chronic Mammary Tumor—of the size of a walnut, in a woman thirty-two years old. It was movable, and located at the periphery of the breast, near the axilla. Excised by a straight incision of two and a half inches.

Caries of Femur—in a man thirty-six years old, following an injury six years ago, caused by falling on the ice and striking on the great trochanter. Fragments of bone had from time to time been discharged from fistulous openings over the trochanter. Several sinuses, communicating with denuded bone, were laid open, and the diseased surface removed by rasp and gouge.

Hæmorrhoids—in a man. Transfixed and tied.

Epulis—recurrent, in a woman thirty-six years old. The tumor was of the size of a large pea, and located near the second molar tooth. Excised.

Thyroid Tumor—congenital, in a child nine years old. Painless, firm, closely adherent to one side of the thyroid gland. A straight incision of two inches was made through the skin and fascia, and a glandular tumor, the size of a large grape, exposed and dissected out. Its removal was attended by free, oozing hæmorrhage, out of proportion to the size of the tumor, but commonly accompanying the excision of this variety of morbid thyroid growths.

Submaxillary Tumor—painless, movable, and of four years' duration, in a woman eighteen years old. A curved incision was made in the submaxillary triangle, a flap of skin and fascia reflected, and the growth, which was of the size of an English walnut, excised; it was closely adherent to the submaxillary gland. On section, it presented the appearance of a "mixed cartilaginous" tumor, such as is commonly found in the parotid region.

Erectile Tumor of Lip—involving the whole thickness of the upper lip from one commissure to its centre, and extending from the vermilion border to the nose, making the diseased portion twice as thick as the sound part. The integumental surface was stained a deep claret color, and presented a number of cicatrices, indicating the points at which ineffectual attempts to destroy the growth had been made with ligatures and caustics before patient entered the hospital. The bloodvessels supplying the tumor were large, and pulsated strongly. Its size could be diminished by direct compression, but it rapidly re-filled with blood when this was discontinued. The galvanic cautery was plunged into the lip at different points, and held until the coagulation was sufficiently firm to prevent hæmorrhage and insure destruction of the erectile tissue.

Stricture of Urethra—of four years' duration and gonorrhœal origin, in a man thirty-seven years old. Under ether, it barely admitted the filiform bougie of Voillemier's divulsor. The metallic guide was then attached, the stricture ruptured, and a large, elastic catheter passed into the bladder and left.

Abdominal Abscess—in a man twenty-five years old. One year ago, he fell fifteen feet, and struck on his back in the right lumbar region. Three months ago, he began to have more or less pain in this locality, and three weeks ago, first noticed a swelling at the same point; the latter had gradually increased, and extended forward to the groin, and downward beneath Poupart's ligament into the thigh. The swelling in the back was punctured with a trocar, and three pints of pus evacuated; during its removal, the swellings in the groin and thigh disappeared.

Extrophy of the Bladder—in a boy nine years old. Immediately above the penis was a rounded, vascular swelling, covered with mucous membrane, and consisting of the protruded, posterior wall of the bladder; its protrusion varied with the amount of pressure from behind and with the respiratory movements. It was extremely sensitive, and constantly irritated by the contact of clothing. On one side, the testicle had descended, on the other it had not. On the former was a reducible, oblique, inguinal hernia. The open mouths of the ureters could be seen at the lower part of the swelling, and urine canstantly dropped from them on the parts beneath. The umbilicus was wanting. An oblong square skin flap, two and

one-half inches wide by three and one-half inches long, was dissected from the groin, scrotum and lower part of the abdomen, leaving a broad pedicle bordering on the mucous surface described; the integumental surface of this flap was laid upon the mucous surface of the bladder, forming an anterior wall. To protect this raw surface, and provide for the lateral wall of the other side, a second skin flap was taken from the same region of the opposite side and laid upon it. The free borders of the flaps were stitched together by silver wire sutures. The raw surfaces left, from which the flaps were taken, were covered, as far as possible, by the adjoining integument, and the remainder left to granulate. Other steps to complete the result were contemplated when cicatrization had taken place.

Hare-lip.—Edges refreshed, and the wound closed by silver sutures.

H. H. A. BEACH.

BOSTON CITY HOSPITAL.

(Friday, June 19.)

Ulceration of Rectum and Hæmorrhoids.—Sphincter cut, and nitric acid applied.

Epithelioma of Lip.—This was an extensive, but rather superficial growth, occupying about three-quarters of the length of the lower lip, and reaching just below its red border. After removing it, by a long, straight incision, parallel with the lip, the skin and mucous membrane were stitched together. Then a curved incision was started, about a quarter of an inch below the first one in the median line, and carried downward and outward over the chin for more than an inch on each side. By means of this, the lower lip was raised to its original level, without entirely dividing it in the operation.

W. P. BOLLES.

Correspondence.

LETTER FROM VIENNA.

[From our Regular Correspondent.]

VIENNA, AUSTRIA, May 14, 1874.

MESSRS. EDITORS,—In my first letter, I informed your readers that the scientific medical world here had celebrated the seventieth birthday of Rokitansky. Now it may not be uninteresting to those who have heard the magnificent lectures of Prof. Hyrtl, to learn that, on the 16th of March last, the students of the Vienna high school have assembled, about 3,000 in number, to express their appreciation, their high regard and esteem for that great master mind, the teacher of anatomy, who has labored incessantly in the interest of knowledge and medical science for nearly half a century, the man who is justly considered, with the few equals he has—perhaps Henle and Luschka may be called such—one of the most famous living anatomists.

Hyrtl's topographic and descriptive anatomy, his anatomical preparations are models of art, and, I dare say, are known the civilized world over. I do not intend to eulogize him, whom most of the literary and scientific societies all over the globe have elected an honorary member. Nor do I intend to give you a detailed account of the speeches made, of the enthusiasm displayed during the time Hyrtl was seen shedding tears when he took leave of and bade farewell to his pupils, who admired his genius and truly loved him like a father. He announced, on that occasion, that he retires from the chair of anatomy, which he has adorned since 1837.

Professors Carl Langer and Voigt now fill the chair of descriptive anatomy; the latter has acquired great fame by his artistic dissections of the finest fibrillæ of the nerves of the skin. Prof. Recklinghausen, now of Strassburg, has been here a short time ago. He is said to have accepted the offer of the

chair of morbid anatomy, proffered to him by the Austrian government.* The designated successors are great men in a scientific sense of the word, and will endeavor to sustain the name of the Vienna school; but it will take a long time for either Langer, or Voigt, or Recklinghausen to establish a reputation like that of Hyrtl or Rokitansky.

There are, at present, quite a number of American physicians here; last winter I counted about sixty at one time, who are visiting the lecture-rooms of the Allgemeine Krankenhaus, and are attending the kliniks and poliklinics in this city. Many of these American students are Bostonians.

Shortly after my arrival in Vienna, I noticed a large glass case, containing orthopædic surgical appliances and apparatus, presented to Prof. Billroth by the inventor, Dr. Chas. Fayette Taylor, of New York. I have seen similar appliances at the St. Luke's Hospital in New York, used by patients suffering from coxitis, tumor albus genu, lordosis, scoliosis, kyphosis, genu valgum, pes equinus, varus and valgus. In short, the very ingenious apparatus of Taylor for the treatment of all kinds of deformities of the human frame have been received here with great satisfaction by the profession. To testify their appreciation of the merits of Dr. Taylor, the "Gesellschaft der Aerzte," of this city, have elected him, upon the recommendation of Billroth, an honorary member of the society. At the meeting of the society mentioned, held on the 6th of March last, Prof. Rokitansky presiding, the Secretary, Dr. Auspitz, reported the receipt of several medical publications, among which was the Medical and Surgical History of the War of the Rebellion, by Surgeon-General Joseph K. Barnes, of the U. S. Army. The General kindly sent me, last year, a copy of the same work. Having perused it, I can say that it is one of the most valuable additions to the medical literature of the day, and its publication reflects great credit on the chief officer of the medical staff of the army, as well as on those who have labored with him to make this work on military surgery one of the best in the world.

In this connection, it will not be uninteresting to your readers to learn that my former schoolmate, Dr. Carl Heitzmann, the greatest living anatomical draughtsman, whose anatomical, pathological, ophthalmoscopic, histological, surgical and other drawings are famous wherever medical science is taught, has expressed to me the intention to take up his residence in the United States, probably in New York. He has never practised his profession—in a monetary sense of the word—but has devoted his whole time, his talent and energy to the production of his elegant works of art, that are known, or ought to be known, to every medical practitioner and student. Heitzmann has also studied the English language for a number of years, and speaks it fluently.

I do not wonder that so many American gentlemen come here to complete their medical education. In the first place, they can learn here the German language with ease within a year, and thus be enabled to follow the German literature without being compelled to rely upon the translations of others; in the second place, the expenditures of living need not exceed the modest sum of 800 dollars a year. For this sum, one can live comfortably, and have the pleasure of attending the lectures of such coryphei as Hebra, Langer, Voigt, Braun, Späth, Billroth, Dumreicher, Dittel, Rokitansky, hereafter, probably, Recklinghausen—in his stead as mentioned above—Stricker, Wedl, Brücke, Bamberger, Duchek, Löbl, Sigmund, Zeissl, Arlt, Jäger, Stellwag, Störk, Schrötter, Schnitzler, Pollitzer, Gruber, Benedikt, Rosenthal, Wiederhofer, Weinlechner, Monti, with their corps of learned assistants and secundarärzte, &c. Each and everyone of the gentlemen mentioned has not only contributed largely to the advancement of medical science, but they are teachers *par excellence* to prove what I say. I defy any one who has carefully attended their lectures to tell me that he has to regret having spent his time and money in Vienna without having accomplished what he wanted, viz., to gain knowledge in any specialty in the science of medicine.

* We understand, from later advices, that Prof. Recklinghausen has declined the appointment.—Eds.

I do not wish to detract in the least from the merits of the eminent gentlemen who teach medicine in America, many of whom have attained a world-wide reputation; but is it not natural that a school nearly three hundred years old, as the Vienna University is, and wholly supported by the general government, should have more material at its disposal in the shape of collections and specimens, with models of appliances and of men to use them, who are sought not only in this empire, but throughout Europe, and who are induced to come here by large salaries paid to them during their natural lifetime, than in our country, where the colleges are more or less private institutions? If our national government were to establish one or two national universities, where the professors would obtain a life-long appointment, with magnificent salaries, like those paid here, which are magnificent in consideration, of course, of the cost of living, could we not find a corps of teachers out of our fifty odd colleges in the United States without drawing from other countries?

In conclusion, I beg you, Messrs. Editors, to allow me to express my joy, through your valuable JOURNAL, at the news which I read in the *New York Medical Record*, that the New York Academy of Medicine, New York Pathological, the New York County Societies, and New York Medical Library Association have passed resolutions favoring the Army Medical Staff Rank Bill, and I hope all the other medical societies throughout the land will act in the same brotherly spirit towards the Army Medical Staff.

Very respectfully yours, RUDOLF TAUSZKY.

Medical Miscellany.

THE CANADA MEDICAL ASSOCIATION holds its seventh annual meeting at Niagara Falls, on Wednesday, August 1, 1874.

FINE OF A DRUGGIST.—A Paris druggist has just been fined 500 francs for selling, without an order from a physician, pastiles made of calomel.

DR. F. W. DRAPER has been appointed Secretary, *pro tempore*, to the State Board of Health, to perform the duties till a permanent successor to Dr. Derby has been chosen.

BRISTOL SOUTH DISTRICT MEDICAL SOCIETY.—We regret that the name of Dr. John Pierce, of Edgartown, was accidentally omitted from the list of Councillors which we published June 4th.

HYDROPHOBIA.—According to M. Bourrel, a veterinary surgeon at Paris, *canine rabies* may be prevented by blunting the canine and incisor teeth of the animal. He has tried it!

SUBCUTANEOUS INJECTION OF HYDRATE OF CHLORAL.—M. Ore condemns the subcutaneous administration of this drug, as being useless if the dose be too small, and as giving rise to abscesses if the dose be sufficiently large to produce therapeutic results.

MALPRACTICE IN VACCINATION.—The tribunal of Strasbourg has recently condemned a physician to imprisonment for one month for communicating syphilis to an infant, which he had inoculated with virus carelessly taken from the arm of another infant suffering from that affection.

HYDRATE OF CHLORAL IN NOCTURNAL INCONTINENCE OF URINE.—Dr. Vecchietti Eduardo has successfully treated several cases with this drug. He believes that idiopathic nocturnal incontinence is due to hyperæsthesia of the bladder, and that chloral acts as an anæsthetic of the great sympathetic. —*Medical Press.*

LONGITUDINAL FRACTURE OF THE HUMERUS.—A case of this rare injury is reported in the *Deutsche Zeitschrift für Chirurgie*, extending the entire length of the bone, caused by supporting a heavy ladder with the arm stretched upwards to its utmost capacity. Abscesses supervened, complicated with erysipelas, and more than two years elapsed before recovery.

ANTAGONISM OF ATROPINE AND MORPHIA.—Dr. Antonio di Bernardo recently treated a case of poisoning by atropine, occurring in an infant of six years, who swallowed an eye-wash containing about 0·042 milligrammes of atropine, by injections of chlor-hydrate of morphia. The case terminated successfully.—*Gazette Hébdomadaire*, No. 8; *Medical Press.*

THE INUNDATED DISTRICT.—Dr. Cheairs, of Arkansas, writes that in the overflowed lands along the Mississippi, the stench is almost beyond endurance. Dead mules, cows, hogs, sheep, wild game of our forests all seem to have suffered a like fate. A reasonable estimate would be to say that 200,000 people are now dependent upon the government for food.—*Medical and Surgical Reporter.*

FISSURE OF THE ANUS IN AN INFANT.—Mr. J. Hyde Houghton reports a case of fissure of the anus in a delicate child, one year and a half old, in consequence of which obstinate constipation was produced, and for some time it never had a motion of the bowels without aperients or enemata. It frequently went two or three days without relief to the bowels, and each act of defæcation was attended by violent pain, screaming and crying. The fissure was finally incised, and the operation was followed by immediate and permanent relief.—*British Medical Journal.*

A NEW METHOD FOR WHOOPING COUGH.—A medical man was suddenly called, a few days since, by an "intelligent" American woman to see her child, who was "almost suffocated in a paroxysm of whooping cough." She had "let the gas into the child's chamber, having heard that whooping cough was relieved by taking the patient to gas works, and, as that could not be conveniently done, had adopted this way to get the same effect."! She said "the child grew worse almost at once."! "Oh judgment! thou hast gone—"

ARSENIC POISONING BY A GREEN CARPET.—At a recent meeting of the Swedish Medical Society of Stockholm, Dr. Kjellberg related the case of a young man, who, having manifested symptoms of arsenic poisoning, was sent away to travel. During the following year, he enjoyed perfect health, but, having at length returned home, he began to suffer, shortly after, in the same manner as before. Suspicion was now directed to a green carpet upon the floor of his chamber, and an analysis revealed the fact that there was contained in the coloring matter a very considerable quantity of arsenic. The removal of this carpet was followed by an immediate disappearance of all the morbid symptoms.—*Hygeia, Stockholm*, Oct., 1873.

DIED,—In this city, 20th inst., George Derby, M.D., aged 55.

MORTALITY IN MASSACHUSETTS.—*Deaths in seventeen Cities and Towns for the week ending June* 13, 1874.

Boston, 108; Worcester, 8; Lowell, 17; Milford, 3; Chelsea, 6; Cambridge, 20; Salem, 6; Lawrence, 9; Springfield, 8; Lynn, 6; Gloucester, 5; Fitchburg, 5; Newburyport, 6; Somerville, 7; Fall River, 12; Haverhill, 3; Holyoke, 7. Total, 236.

Prevalent Diseases.—Consumption, 44; pneumonia, 22; scarlet fever, 15.

DEATHS IN BOSTON for the week ending Saturday, June 20th, 113. Males, 58; females, 55. Accident, 5; aneurism, 1; apoplexy, 1; asthma, 1; anæmia, 1; bronchitis, 3; inflammation of the brain, 1; disease of the brain, 1; cancer, 3; cholera infantum, 2; cholera morbus, 1; consumption, 26; convulsions, 2; croup, 1; debility, 1; diarrhœa, 5; dropsy, 1; dropsy of the brain, 3; drowned, 2; diphtheria, 1; erysipelas, 1; scarlet fever, 1; typhoid fever, 3; "typho-malarial" fever, 1; disease of the heart, 5; homicide, 1; intemperance, 1; perforation of the intestines, 1; disease of the kidneys, 3; disease of the liver, 2; congestion of the lungs, 1; inflammation of the lungs, 11; marasmus, 4; measles, 2; old age, 2; premature birth, 3; puerperal disease, 3; scalded, 1; suicide, 1; teething, 1; whooping cough, 3.

Under 5 years of age, 43; between 5 and 20 years, 7; between 20 and 40 years, 35; between 40 and 60 years, 12; over 60 years, 16. Born in the United States, 76; Ireland, 24; other places, 13.

Supplement to the
Boston Medical and Surgical Journal.

THE PRIZE ESSAYS OF THE

BOYLSTON MEDICAL SOCIETY,

FOR 1874.

I.
EXPERIMENTS ON THE ACTION OF BILE IN PROMOTING THE ABSORPTION OF FATS.

II.
ON INTESTINAL DIGESTION.

[The experiments in both the following Essays were performed in the laboratory of Dr. H. P. Bowditch, Professor of Physiology in the Harvard Medical School.]

EXPERIMENTS ON THE ACTION OF BILE IN PROMOTING THE ABSORPTION OF FATS.

By Charles H. Williams, A.B., of Boston.

The Essay to which was awarded the First Prize of the Boylston Medical Society for 1874.

A number of experiments have been made, to prove that the presence of bile in the intestines favors the absorption of fat. Bidder and Schmidt* "fed a healthy dog with a carefully-ascertained amount of fat. By examination of its fæces, it was found to have absorbed 11.1 grammes for each kilogramme of its weight. Another dog, in which biliary fistula had been established, was similarly fed; the animal was allowed to lick some of the bile from the wound, and it was proved that but 2.24 grammes of fat had been absorbed for each kilogramme of weight. In a third, in which all access of bile to the intestine had been cut off, only 1.56 grammes was absorbed." Brodie† states that, after tying the common bile duct on young cats, no chyle was to be found in the lacteals and thoracic duct. Tiedmann and Gmelin‡ find that the fat absorption is diminished, but not entirely stopped under these circumstances. Ludwig§ says: "The proof of the diminished absorption of fat during the obstruction to the inflow of bile is shown by this, that the chyle coming from the small intestine is poorer in fat, and the fæces are correspondingly rich in fat." Kühne‖ gives an experiment, in which a healthy dog was carefully fed with fat, until it began to appear in the fæces. The quantity which he was taking was then noted, a biliary fistula was made, and it was then found that the quantity of fat which could be given without having any appear in the fæces was very much smaller than before.

Such, then, being the established fact, how is it to be explained? Marshall¶ says: "It certainly does not appear to act chemically, by decomposing, or dissolving neutral fats, nor does it make, with oily matters, a permanent emulsion." The object of this paper, however, not being to discuss any chemical relation of the bile, we leave the point with this statement.

Another way in which bile may aid in the passage of fats into the lacteals, is by a mechanical influence of some kind. Wistinghausen** states, in beginning an account of some experiments on this subject: "The first (bile), attracted more strongly by the membranes, carries, mechanically, the particles of oil adhering to it, without having previously changed their chemical constitution." These experiments seem to have been the fullest and most complete which have yet been made on this subject. His apparatus and method was this:†† "A glass tube, six feet long, was bent so as to have one part shorter than the other; over the short (leg) was stretched a freshly-dried, thin mucous membrane, from an ox intestine. Through the long leg, the tube was filled with the liquid in question, the air removed by proper

* Marshall's Outlines of Physiology, p. 557.
† Quarterly Journal of Science and the Arts, January, 1823, p. 341.
‡ Verdauung, ii. p. 47.
§ Lehrbuch der Physiologie, ii. p. 658.
‖ Lehrbuch der physiologischen Chemie.
¶ Marshall's Outlines of Physiology, p. 556.
** Reichert und Du Bois Reymond's Archiv, 1873, No. 2, p. 130.
†† Ibid., p. 141.

means, and mercury, employed to obtain pressure, was poured into the long leg, until the fluid began to pass through the membrane on the short leg; then the height of the mercury was measured." In some later experiments, a larger tube was fitted round the end of the short leg, to form a cell, in which liquid could be placed.

Being led to make some experiments to illustrate the same points, the author desired to repeat the experiments of Wistinghausen; but as his methods were not fully explained, it was impossible to do so. For instance, he gives a number of experiments, in which oil came through a membrane with so many m.m. of mercury pressure; but he does not state whether the time was the same in each case, or not. Again, it is not stated in what way the mercury was poured into the long leg; whether in a constant stream, until the oil appeared through the membrane, or whether, after pouring in a certain amount of mercury, he waited, and then added more, and so on. No mention of time is made, in connection with his experiments, until we reach the ninth page of his essay, when we begin to have given the time required for the passage of the oil, with a certain pressure of mercury.

The following apparatus was, therefore, constructed. Over the lower ends of two glass tubes, parchment was stretched. The upper ends were connected with a pressure bottle, arranged in the following way: Into a Wolf bottle, was poured some mercury; through one neck was fitted a tube, which dipped beneath the mercury; the tubes were connected with another neck, and, through the third opening, water was forced in, thus compressing the air above, the pressure being shown by the rise of the mercury in the tube. When the required height was reached, the water was allowed to dribble in just fast enough to make up for leakage and the outflow through the tubes.

The object, then, was to note the difference in time, required to force oil through a membrane moistened with bile, and one wet with water, the pressure remaining the same. For this purpose, one piece of parchment was moistened with bile, the other with water; these tied securely over the ends of the tubes, oil poured into each tube, and pressure applied. After making eleven experiments with parchment, parchment-paper and hog's bladder, it was found that the results were not entirely consistent, that the different pieces of membrane were apt to vary in texture, and that it was difficult to prevent leakage. A membrane was then sought for which should be entirely homogeneous, and an apparatus which would admit of ready adjustment, and prevent leakage. The following apparatus was then constructed. A piece of brass tube, about a foot long, was bent to a U shape, one arm being longer than the other. To the top of the shorter arm, was soldered a brass plate, having a hole in the centre; upon this was placed a similar plate; the two were then ground to fit, and held together by four screws. The whole was held by a suitable stand, so that the plates were horizontal. To the longer arm, a pipe was tightly fitted, which connected the tube with a pressure apparatus, consisting of the ordinary arrangement of two bottles, the mercury in that which is placed on the higher level, running into the other, and compressing the air in it. The amount of pressure was indicated by a manometer tube.

In using this apparatus, the following order was followed. The

brass tube was first filled with the oil, or emulsion, which it was desired to pass through the membrane, until the oil was on a level with the lower brass plate. Next, the membrane, dry, or previously soaked in some fluid, was laid on the brass plate, no air coming between the membrane and the oil. The second plate was then put on and screwed down; and if the membrane had been previously wet with any fluid, a few drops of that fluid were placed upon it, to make sure that it should be kept moist. Next, the pressure apparatus was connected with the brass tube, clamped on, and the bottle of mercury raised until the manometer tube showed the requisite pressure. The time was then noted. After this, the membrane was watched with a Hartnack microscope (objective 2, eye-piece 3), placed vertically over it, until the drops of oil were seen coming through, when the time was again noted. The difference between the times, gave the minutes and seconds required for the oil to penetrate the membrane.

In the first experiments, parchment paper was used as the membrane. The small squares were all from the same sheet of paper. The following results were obtained:

I.—*Experiments with dry Parchment Paper.*—Pure olive oil was placed in the tube, and, in the first series, *no pressure* was used, the time being noted when the first glistening lines of oil appeared on the paper. The numbers indicate the minutes and seconds required for oil to come through the membrane.

First Series.—Time, 7′,30″; 11′; 11′,15″; 6′,45″; 10′; 10′; 12′,15″; 8′,15″; 11′. Temperature, 65° Fahr.

Second Series.—Seven and a half centimetres of mercury pressure. Time, 3′,15″; 3′; 3′; 4′; 3′; 2′,30″; 4′; 2′,45″; 3′,15″. Temperature, 70° Fahr.

Third Series.—Same pressure (seven and a half centimetres); temperature, 60° Fahr. Time, 6′; 5′,30″; 5′; 6′; 4′,45″; 5′; 5′,15″; 6′,30″.

Fourth Series.—Fifteen centimetres of pressure. Temperature, 68°. Time, 3′; 3′,45″; 3′; 3′,30″; 4′; 2′,30″; 4′,25″; 3′,30″; 3′,15″; 3′; 4′,45″.

Fifth Series.—Thirty centimetres of pressure. Temperature, 64°. Time, 2′,57″; 3′,10″; 3′; 2′; 2′; 2′,50″; 2′,10″; 2′,10″; 2′,55″.

II.—*Experiments with Parchment Paper Wet with Water.*

First Series.—Fifteen centimetres of pressure. Temperature, 68°. Time, 14′,20″; 12′; 12′; 17′; 11′.

Second Series.—Thirty centimetres of pressure. Temperature, 67°. Time, 4′,30; 6′,10″; 4′,20″; 8′, 20″; 6′; 6′; 3′,50″; 5′,45″; 3′30″; 5′,45″.

III.—*Experiments with Parchment Paper Wet with Bile.*

First Series.—Fifteen centimetres of pressure. Temperature, 64°. Time, 4′; 4′,20″; 4′,45″; 3′,55″; 3′,45″; 3′,05″.

Second Series.—Thirty centimetres of pressure. Temperature, 66°. Time, 1′,45″; 2′,00; 1′,48″; 1′; 1′,05″; .45″; 1′.

Table A.—Parchment Paper used as the Membrane.

Pressure of Mercury in c. m.	Membrane Dry.			Wet with Water.			Wet with Bile.		
	No. of Exp.	Average.	Variation.	No. of Exp	Average.	Variation.	No. of Exp.	Average.	Variation.
0	9	9′,46″	5′,30″						
7½	17	4′,17″	4′,						
15	11	3′,31″	2′,15″	5	13′,16″	6′,	6	3′,58″	1′,40″
30	9	2′,35″	1′,10″	10	5′,25″	4′,50″	7	1′,20″	1′,15″

(Note.—When the membrane was used wet, the surfaces were wiped of superfluous fluid, just before placing the membrane on the oil.)

From these experiments, it will be seen that, with each pressure, oil came through a membrane moistened with bile faster than when it was moistened with water, though not so fast as when dry. There was found, however, to be a great variation between the different experiments at the same pressure, and at times the oil would well up rapidly through some thin spot of the paper, before it had appeared on any other part. Also, on removing the oil from some of the pieces, by soaking in ether, drying, and repeating the experiments, the results were very unsatisfactory.

A new membrane was therefore sought for, which should be as homogeneous as possible, and sufficiently porous to admit of oil passing through without much difficulty. As the membranes through which absorption takes place must be supposed to contain minute, capillary spaces, through which the fats find their way, an endeavor was made to construct an artificial membrane or substance, which should consist mostly of minute capillary spaces. For this purpose, sheets were made of plaster of Paris, the thickness being reduced until one millimetre was reached. They were prepared by pressing out this fluid plaster between pieces of thick plate glass, separated from each other one millimetre. When quite firm, the plaster was removed, and, while translucent, all portions containing air-bubbles were marked; the cake was then dried, and cut into squares for use. Twenty experiments were then made with different sheets of dry plaster, the oil having a pressure of fifteen centimetres of mercury.

It was now found, however, that, to obtain uniform results, the plaster must always be made with the same proportion of water; otherwise, when more water was used, the pores were rendered larger, and the oil came through more readily. The following experiments were all made with squares from one sheet of plaster. Thin plaster was used as the membrane (Sheet I.), and pure olive oil was placed in the brass tube. In the first series of experiments, with no pressure, the capillary force was not sufficient to bring any amount of oil to the upper surface, so the time was taken when the first glistening lines appeared.

IV.—*Experiments with Dry Plaster.*

First Series.—No pressure. Temperature, 62°. Time, 5′,50″; 6′, 30″; 6′,15″; 6′,15″.

Second Series.—Seven and a half centimetres pressure. Temperature, 54°. Time, 4′; 3′,50″; 4′,10″; 3′,45″.

Third Series.—Pressure, fifteen centimetres. Temperature, 62°. Time, 3′,20″; 3′,10″; 3′,30″; 3′,05″; 3′,15″.

Fourth Series.—Pressure, thirty centimetres. Temperature, 62°. Time, 1′,50″; 1′,52″; 1′,54″; 1′,32″.

V.—*Experiments with Plaster Wet with Water.*

Pressure, thirty centimetres. Temperature, 62°. No oil in 40 minutes; no oil in 45 minutes. After two hours and three quarters, a few drops appeared.

VI.—*Experiments with Plaster Wet with Bile.*

Pressure, thirty centimetres. Temperature, 64°. Time, 10′,30″; 8′; 9′,25″; 8′,45″; 10′,20″.

Table B.—Thin Plaster (Sheet I.) used as the Membrane.

Pressure of Mercury in c. m.	Membrane Dry.			Wet with Water.			Wet with Bile.		
	No. of Exp.	Average.	Variation.	No. of Exp.	Average.	Variation.	No. of Exp.	Average.	Variation.
0	4	6′,12″	0′,40″						
7½	4	3′,56″	0′,25″						
15	5	3′,16″	0′,25″	No oil in 40 minutes.					
30	4	1′,47″	0′,22″	" " " 45 "					
				3, few drops after 2¾ hrs.			5	9′,24″	2′,30″

The next series of experiments were made with another sheet of plaster (Sheet II.).

VII.—*Experiments with Dry Plaster.*

First Series.—Pressure, fifteen centimetres. Temperature, 64°. Time, 3′,11″; 3′; 3′; 2′,35″; 2′,45″; 2′,55″.

Second Series.—Pressure, thirty centimetres. Temperature, 64°. Time, 2′,14″; 2′,10″; 1′,56″; 2′,02″; 2′,04″; 2′.

VIII.—*Experiments with Plaster Wet with Water.*

First Series.—Pressure, seven and a half centimetres. No oil after twelve hours.

Second Series.—Pressure, fifteen centimetres. No oil after 6 hours. After 23 hours, a large amount.

Third Series.—Pressure, thirty centimetres. After 3½ hours, there was a thin layer over the plaster. After 4½ hours, a small amount had come through.

Fourth Series.—(a) Pressure, forty-five centimetres. After one hour and five minutes, one drop appeared on the surface of the plaster; at one hour and thirty-five minutes, about twelve drops had come through; in two hours, quite a number of drops.

(b) After one hour and ten minutes, one drop; one hour and twenty minutes, a number of drops; one hour and fifty minutes, the surface of the plaster was thickly dotted over with them.

Fifth Series.—Pressure of sixty centimetres. Time, 1 hour and 2 minutes; 1 hour; 50 minutes.

IX.—*Experiments with Plaster Wet with Bile.*

First Series.—Pressure, fifteen centimetres. After 2 hours, a little oil appeared. After 2¼ hours, a little oil appeared.

Second Series.—Pressure, thirty centimetres. Time, 20′; 19′,20″; 20′,10″; 19′,30″; 19′,18″; 20′; 20′; 19′,30″; 19′,20″.

Third Series.—Pressure, forty-five centimetres. Time, 13′; 12′,20″; 14′,30″; 15′,30″

Fourth Series.—Pressure, sixty centimetres. Time, 8′; 7′; 7′;

Table C.—Thin Plaster (Sheet II.) used as the Membrane.

Pressure of Mercury in c. m.	Membrane Dry.			Memb. Wet with Water.			Memb. Wet with Bile.		
	No. of Exp.	Average.	Variation.	No. of Exp.	Average.	Variation.	No. of Exp.	Average.	Variation.
7½				1; no oil after 12 hours.					
15	6	2′,54″	0′,36″	No oil after 6 hours; after 23 hours, large amount.			After 2 h., a little oil. " 2¼ " " " "		
30	6	2′,04″	0′,18″	3½ hours, thin layer. 4½ " small amount.			9	19′,41″	0′,52″
45				1 h. 50′, number of drops. 2 hours, " " "			4	13′,50″	3′,10″
60				2	57′	12′	3	7′,20″	1′

In these experiments, the bile was taken from an ox, killed only a few hours before; it was neutral to test paper, and had a specific gravity of 1023.

In all cases in which the membrane was moistened with bile, when the oil began to come through, it appeared in very finely-divided particles, just visible by the microscope, giving in mass the appearance of a whitish cloud rising from the surface of the plaster.

On the other hand, when the membrane was moistened with water, the oil came through, forming a small globule, which gradually enlarged. Finally, when it had reached sufficient size for its specific gravity to free it from its adhesion to the plaster, it rose to the top of the water, which covered the membrane.

All the previous experiments were made with olive oil; a few were now tried with different emulsions, but with uncertain results. The oil seemed to come through first, and when the emulsions were colored, most of the coloring matter was retained on the under surface of the plaster.

Rabbit's bladder was also tried for the membrane; but this could not be procured in sufficient quantity to give any extended series of experiments.

What, then, can we infer from these results?

1. That when a membrane is wet with bile, it allows oil to pass through more easily than when it is wet with water.

2. That, as the pores of the plaster cannot be supposed to change their shape, being made of a perfectly inelastic material, therefore bile cannot favor the passage of the oil by affecting any such change of form in the pores.

3. That, as the oil is more finely divided when it has passed through plaster moistened with bile than when it is wet with water, or used dry, therefore the bile must have some influence in effecting this.

Ludwig* makes the following statements, which have some bearing on these facts: "The assistance which the bile renders to the passage of fat is best explained by this, that the obstruction which the pores oppose to the passage of fats is diminished.

"This (conclusion) can be reached in various ways; for example (a), by this, that the bile, pressed into the thin, mucous membrane, alters the form of the pores, and lessens the firmness of the tissues; or (b), that it makes the surface of the pores more slippery, so that the friction between the oil and the walls of the pores is lessened; or (c), that it makes the fat drops more capable of adapting themselves to the form of the porous canals, in that it diminishes the so-called drop-tension of the fats." The first of these explanations we have eliminated by the use of plaster as the membrane; the third seems likely, on account of the finely-divided appearance of the fat which comes through bile; and the second, although we have no proof of it, seems probable.

It may be said that, although the previous experiments show that oil goes through faster when the membrane is wet with bile than when it is moistened with water, yet that this does not prove that if some other liquid were used it would not go through faster still. The following experiments were performed to examine this point.

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* Lehrbuch der Physiologie, ii. page 658.

The whole series was made from pieces of the same sheet of plaster (Sheet III.).

X.—*Experiments with Dry Plaster* (made to be able to compare the times which this sheet of plaster gives with the times of the other sheets).

First Series.—Pressure, fifteen centimetres. Temperature, 65°. Time, 3′,35″; 3′,45″; 3′,15″.

Second Series.—Pressure, thirty centimetres. Temperature, 65°. Time, 1′,40″; 1′,55″; 2′; 1′,55″.

Third Series.—Pressure, forty-five centimetres. Temperature, 62°. Time, 1′,25″. 1′,50″; 1′,25″; 1′,45″; 1′,23″.

Fourth Series.—Pressure, sixty centimetres. Temperature, 62°. Time, 1′,05″; 1′; 1′,10″; 1′,07″.

XI.—*Experiments with Plaster wet with Bile which had been made Alkaline with a Solution of Soda.*

Pressure, sixty centimetres. Temperature, 64°. Time, 3′,50″; 3′, 52″; 3′,30″.

XII.—*Experiments with Plaster wet with a one per cent. Solution of Soda.*

Pressure, sixty centimetres. Temperature, 60°. Time, 3′,20″; 4′; 3′,45″; 4′,30″; 4′.

XIII.—*Experiments with Plaster wet with fresh Ox Bile.*

Pressure, sixty centimetres. Temperature, 65°. Time, 4′,40″; 4′, 50″; 5′,10″.

XIV.—*Experiments with Plaster wet with Bile made Acid by Hydrochloric Acid.*

Pressure, sixty centimetres. Temperature, 57°. Time, 5′,10″; 5′, 45″; 5′,15″.

XV.—*Experiments with Plaster wet with Bile made Acid by Acetic Acid.*

Pressure, sixty centimetres. Temperature, 57°. Time, 6′,30″; 5′, 42″; 5′,20″; 6′.

XVI.—*Experiments with Plaster wet with Water.*

Pressure, sixty centimetres. Temperature, 65°. Time, 6′,40″; 6′, 15″; 6′,30″.

XVII.—*Experiments with Plaster wet with Hydrochloric Acid (one per cent.).*

Pressure, sixty centimetres. Temperature, 65°. Time, 9′; 8′,45″; 9′,30″.

Table D.—Thin Plaster (Sheet III.) used as the Membrane.

Pressure of Mercury in c. m.	Membrane Dry.			Memb. Wet with Water.			Memb. Wet with Bile.		
	No. of Exp.	Average.	Variation.	No. of Exp.	Average.	Variation.	No. of Exp.	Average.	Variation.
15	3	3′,32″	0′,30″						
30	4	1′,53″	0′,20″						
45	5	1′,33″	0′,27″						
60	4	1′,05″	0′,10″	3	6′,28″	0′,25″	3	4′,53″	0′,30″
	Wet with Soda Solution (1 per cent.)			Wet with hydrochloric acid (1 per cent.)			Wet with bile made alkaline with soda solution.		
60	5	3′,55″	1′,10″	3	9′,05″	0′.45″	3	3′,44″	0′,22″
	Wet with bile made acid by hydrochloric acid.			Wet with bile made acid with acetic acid.					
60	3	5′,23″	0′,35″	4	5′,53″	1′,10″			

Or, arranging them in the order of their time, we get:—

Oil through dry plaster (60 centimetres pressure),									1′,05′
"	"	plaster wet with alkaline bile (60 centimetres pressure),							3′,44″
"	"	"	"	"	solution of soda (1 pr. ct.) (60 centimetres pressure),				3′,55″
"	"	"	"	"	bile	"	"	"	4′,53″
"	"	"	"	"	hydrochloric acid and bile	"	"	"	5′,23″
"	"	"	"	"	acetic acid and bile	"	"	"	5′,53″
"	"	"	"	"	water	"	"	"	6′,28″
"	"	"	"	"	hydrochloric acid (1 pr. ct.)	"	"	"	9′,05″

From these experiments we find that when the membrane is moistened with an alkaline fluid, fats go through quicker than with bile, water or acid; and that the addition of alkali to the bile allows the fat to pass in the shortest time of all. In the small intestine, we have two alkaline fluids poured out, the pancreatic and intestinal juices; these soon render the chyme, which comes down from above, alkaline. Now, if it is allowable to argue from results obtained from inorganic capillary tubes, what the action would be in organic pores, it would seem to follow, from the previous experiments:—

First, that, when the bile is mixed with the alkaline fluids of the intestine, its power of promoting fat absorption will be greatest.

Secondly, that, if either the bile or the alkaline fluids be prevented from entering the intestine, still a certain amount of fat absorption will take place; for if the bile alone flows in, it will exert its specific influence in aiding the mechanical passage of the fats, and if the alkaline fluids only enter, considerable fat will still penetrate the walls, aided by the alkalinity of the fluid, even if there were no other action. These suggestions seem to be sustained by previous experiments, for it has been found that, when all bile was cut off from the intestine, still some fat was absorbed; and, also, when a pancreatic fistula was made, considerable fat was still found in the lacteals—more in amount in the last case, perhaps, because there was still the alkaline intestinal juice, which could not be cut off.

To conclude, we have endeavored to show, by new experiments, and methods differing somewhat from those which have been tried before:—

1. That the passage of neutral fats, through capillary canals or pores, is favored by the presence of bile in those pores.

2. That this action is increased when the bile is rendered alkaline, and diminished when it is acid.

3. That the action cannot be due to the bile changing the form of the pores.

4. That, after passing through membranes moistened with bile, the fats appear more finely divided than with membranes wet with other substances, apparently showing that the drop-tension or cohesion of the fat has been affected.

INTESTINAL DIGESTION.

By G. M. GARLAND, A.B., of Lawrence.

The Essay to which the Second Prize of the Boylston Medical Society was awarded.

ALTHOUGH those who are familiar with the processes of digestion admit that the intestinal juices are important auxiliaries to the performance of that function, yet I venture that the ideas of many will be startled by the recently advanced opinions of Bernard, who states that when the food has escaped from the stomach and become impregnated with the bile, digestion has yet to begin. At this stage of the proceedings, a greater part of the aliments remain unaltered. A small portion of the albuminoids only have been transformed, but the first result of the contact of the bile is to annul that transformation and to precipitate a part of the peptones already formed. "It is, then, in an insoluble form," he says, "that the aliments present themselves before the agents of the intestines which must digest them really and definitely."

This opinion of Bernard is based upon a series of complicated experiments, undertaken by many physiologists with the view of differentiating the functions peculiar to the several secretions of the alimentary canal. Among the intestinal agents, Bernard includes the pancreatic juice as well as the intestinal secretions proper, for he says that it is by the intervention of the pancreatic juice that digestion really begins. I desire, in this paper, however, to illustrate some of the experiments which have been made upon the pure intestinal juice, from which it will be seen that a great diversity of opinion exists among different observers as to the solvent power of that secretion upon the various types of food.

There exist, in the intestinal mucous membrane, four sets of glands, viz.: the solitary glands, Peyer's patches, Brunner's glands and Lieberkühn's follicles. Peyer's patches are merely small colonies of the solitary glands or vesicles, and are ordinarily closed, though they are sometimes found open in the pig (Krause), and also in the human intestine (Allen Thompson). Kühne states that they do not appear to contribute anything to the intestines, except under pathological conditions; but Bernard says they secrete mucus. On the other hand, Brücke has demonstrated that they are small lymph glands, and, hence, have no participation in the performance of digestion.

Brunner's glands are peculiar to the duodenum, and were formerly supposed to correspond to the pancreas in secretion as well as in structure. From recent experiments, however, Bernard concludes that the secretion of these glands possesses no other chemical properties than those of mucus. He says they are analogous to certain agglomerations of muciparous glandules found in the pharynx of the horse, and that their only function is to facilitate the impregnation of the chyme by the bile and pancreatic juice. Lieberkühn's follicles are found throughout the entire length of the intestine, and to them is attributed the function of secreting the intestinal juice proper. It is worthy of remark, however, that Schiff observed that the fluid obtained from a fistula which was located in the duodenum gave more positive digestive results than if the fistula were established lower down in the ileum. From this, we may infer either that Brunner's glands are an

auxiliary in the one case, or that the strength of the secretion of Lieberkühn's glands diminishes as we recede from the duodenum.

The difficulty of determining the function which pure intestinal juice serves in the process of digestion may be understood only when one has considered the difficulty of eliminating from the problem all the extraneous contributions of neighboring organs and of reducing to a minimum the inevitable derangement of the functional integrity of the abdominal organs which follow mechanical interference. So important is this latter factor alone, that Hoppe-Seyler, in apparent despair, says that until we can positively establish the normal condition of the secretion of the intestinal mucous membrane, all experiments must remain without trustworthy results.

Among the early investigators of the subject, Frerichs endeavored to obtain the action of the pure secretion by including a loop of the intestine between two ligatures, washing it out carefully, and then introducing food for digestion. Zander passed a piece of cork into the duodenum below the pancreas, and then tied a ligature about both intestine and cork. Other experimenters adopted similar manœuvres, but their results are of value only as demonstrating the futility of the means they employed for eliminating the secretion of the organs above. By the showing of Schmidt and Zander themselves, the analysis of the juice which they obtained discovered an obvious proportion of gallic acid salts and other imported ingredients.

In 1858, Prof. W. Busch was so fortunate as to have under his observation a woman who had been gored by a bull in such a manner that two fistulæ were established in the small intestine. The right fistula communicated with the stomach by a short section of the intestine, while the second opening, removed a few inches to the left, was connected with the anus by the major part of the intestine. As a result of the inflammation consequent upon the injury, one end of the bit of intestine between the two orifices became sealed up so as to form a cul de sac, and thereby render impossible any communication between the upper and lower portions of the intestine. All the ingesta, therefore, escaped from the right fistula, which constituted an artificial anus. Owing to the small amount of intestine available to the woman, she emaciated with terrible rapidity, and was possessed of so ravenous an appetite that she would continue eating while the food was pouring out of the hole on the right. Busch experimented by introducing free food into the left fistula and allowing it to escape naturally, or by enclosing it in a net bag that he might be able to withdraw it again. He says, in substance, that the amount of the intestinal secretion was only sufficient to moisten the intestinal walls. It changed starch into sugar, and converted cane sugar into grape sugar. It decomposed protein bodies, but with the appearance of putridity and odor of ammonia. The bits of meat which he introduced free into the fistula were entirely dissolved before reaching the anus, though the meat held in the bag was not so completely decomposed. The secretion did not apparently affect fats, as the latter were unabsorbed unless mixed with gall.

Busch did not find the temperature of the abdominal viscera increased during digestion. Braune, however, who had a somewhat similar case of fistula under his charge, noticed an increase of four-tenths of a degree in the temperature of the intestines during digestion. Both

Busch and Braune agree that the secreting glands of the intestine have alternate periods of activity and repose.

The first real advance was made in this investigation by Thiry, when he succeeded in isolating a portion of the small intestine. The method he pursued was as follows: He took a dog which had been fasting at least twenty-four hours, and opened its abdominal cavity by an incision about two inches in length along the linea alba and below the umbilicus. Drawing out therefrom a loop of the intestine, he excised from it a piece ten to fifteen centimetres long, taking care not to sever the piece from the mesentery, or any of its vessels and nerves. Turning aside the isolated piece, he reëstablished the continuity of the intestinal tract by bringing together with sutures the cut ends of the part above and the part below, and then replaced the intestine, minus fifteen centimetres, in the abdomen. Taking up again the isolated piece, he closed one end of it by sutures, and thus made a blind sac of it. He then passed the blind end of the loop into the abdomen, and stitched the open end or mouth of the bag to the edges of the incision in the abdominal walls. If the animal did not die of peritonitis in a few days, he says, the wound generally healed in fourteen days, leaving only a fistulous opening, from which the intestinal juice could be collected.

Thiry experienced a serious obstacle to the establishment of a permanent fistula from the liability of the isolated piece to prolapse. This prolapse occurred in two ways. Either the inner end would become introverted, and, finally emerge from the outer opening, followed by the whole length of the piece, or the outer end would become everted, as in case of prolapsus recti. To avoid these casualties, he made a "bias," so to speak, in the outer end of the loop, which contracted the orifice sufficiently to retain the parts in place, but had the disadvantage of preventing the free egress of the secretion or the ready introduction of food or sponges.

After the healing of the wound, he observed that the fistula did not ordinarily secrete much, unless the mucous membranes were irritated, mechanically, by the insertion of sponges, catheters, or weak hydrochloric acid, or by the application of the induced current. By the assistance of such irritants, he obtained from his fistula four grammes of secretion in an hour. At this rate, a dog would secrete, from the entire length of his intestine, about three hundred and sixty grammes of juice during the five hours allowed him for the digestion of his dinner. The irritation of the vagus nerve by electricity occasioned no secretion, and he inferred that the action of Lieberkühn's glands was governed by the sympathetic system.

Thiry describes the secretion which he obtained as a thin, clear, yellow fluid, strongly alkaline, with an average specific gravity of 1.0115. It gave a precipitate of albumen on being acidified and boiled. An analysis of 1,000 parts of the juice gave: water, 975.85; inorganic salts, 8.79; albuminates, 8.02; other organic materials, 7.34.

As regards the digestive virtues of the pure secretion, Thiry's experiments were almost negative. He says that fats, starch, coagulated white of egg, red muscle and glue were not digested, either within or without the fistula. Fibrin was digested in the natural alkaline solution, but remained unaffected if the juice were acidified or even neutralized. In order to assure himself as to the structural integrity of the isolated piece, he made microscopic examinations after the death

of the animals, but could detect no difference between the structure of the fistula and of other parts of the intestine contiguous to it. He concluded, therefore, that to be of any value, the intestinal secretion must be associated with the other digestive fluids.

As a point of collateral interest, it may not be amiss to mention here the influence of certain drugs upon the isolated loop. Thiry gave the dog at one time a strong dose of sulphate of magnesia, and again a pill of pulverized senna leaves. Both doses produced active catharsis, but did not affect the isolated piece. An injection of a solution of either of the drugs into the loop itself produced no more effect than an injection of distilled water. Six drops of croton oil rubbed upon the dog's abdomen produced vomiting and purging, but had no influence upon the fistula. He reasons, therefore, that these drugs produce catharsis by so exciting peristaltic action that the intestines are emptied of their contents before time has been allowed for the customary reäbsorption of the fluids of the chyme.

Dr. W. Leube reviewed Thiry's experiments, and agreed with the latter that the intestinal juice does not convert starch into sugar. He succeeded, however, in changing cane sugar into grape sugar, and, also, induced an acid fermentation. This fermentation, however, he attributed to the presence of vibriones, as it only occurred when these animalcules were present. In this connection, however, it will be remembered that Bastian asserts that vibriones are one of the products of, rather than the cause of, fermentation.

Leube says that raw fibrin dissolves slowly, and without swelling. He conducted his fibrin experiments by subjecting a couple of shreds of fibrin to the action of five to ten centimetres of intestinal juice for ten to sixteen hours in a digesting oven. The solution was then diluted to double its volume, heated to the boiling point, and acidified with acetic acid to precipitate the albumen. When no more precipitate was formed on further addition of acid, he filtered the fluid and tested the filtrate for peptones. The following are the principles upon which he relied for proving the absence or presence of peptones:

A. The peptones are not precipitated by heating.

B. A solution of peptones, heated with nitric acid in excess, assumes a yellow color, which becomes still deeper on the addition of ammonia (xanthroprotein test).

C. If a solution of the protonitrate of mercury be combined with a solution of peptones and boiled, and then a few drops of nitrous or nitric acid be added, a dark red color will result (Millon's reaction).

D. If the peptone solution be mixed with soda, and a few drops of sulphate of copper, it will form a rose-red color, which gradually passes into a violet color on the further addition of sulphate of copper. If the amount of peptones is considerable, the play of colors will take place more slowly, and requires more of the copper salt.

E. If the ferrocyanide of potash be added to the peptone solution, it produces a turbidity which amounts to a precipitate on heating.

F. Sesquichloride of iron causes a whitish yellow precipitate, which dissolves in an excess of the reagent.

Leube states that, measured by these tests, no other albuminoid substance than fibrin was digested.

Schiff declared that a fistula, to be successful, must be located in the duodenum. In one so situated, he succeeded in digesting fresh

casein, fibrin, and cooked or fresh meat. Starch was converted into sugar as readily as by the pancreatic juice, and oils were emulsified. In other parts of the small intestines, these results were more or less modified. He noticed an evident derangement in the circulation of the isolated part in one instance, and twice discovered atheromatous degeneration in the walls of the vessels of the fistulæ. He remarks that the intestinal villi persisted after the operation, and hence could not owe their existence to the influence of the gall or pancreatic juice.

Wittich rejected Thiry's method, and chose, in preference, a glycerine infusion of the mucous membrane of the intestine, which had been previously washed out by a stream of distilled water. He only experimented on two animals, a porpoise and a rabbit. In both cases, he obtained negative results with fibrin, and in only the first case did he succeed in converting starch into sugar.

In an interesting article upon certain ferments which change starch and cane sugar into grape sugar, Dr. Victor Paschutin relates his experience with intestinal juice. In making a fistula by his method, which is somewhat modified from Thiry's, the hair must be carefully removed from the abdomen of a dog, and an incision, three to five centimetres long, made in the linea alba, between the ensiform cartilage and the umbilicus. The duodenum may be easily recognized and drawn out, as it has no mesentery (Quain). Two ligatures should be passed around the duodenum, close together, and about two and a half centimetres below the pancreas. The intestine may then be severed between the ligatures, and the upper portion replaced in the abdomen.

Owing to the difficulty of following down the jejunum, Paschutin resorted to the expedient of grasping a loop of the intestine haphazard between his thumb and finger, and then injecting the portion above with water. By this means, he could easily follow up the distended gut from his fingers to the jejunum, which is readily recognized by its short mesentery. Here the process of ligaturing and cutting is repeated, and we have a loop consisting of the lower part of the duodenum and the jejunum. The ligatured ends of the upper part of the duodenum and lower part of the jejunum must then be cut away, and the continuity of the intestine restored by sutures. The inner end of the loop, which is everted by the contraction of its external muscular coat, must be inverted so as to approximate the edges of the serous coat, and stitched in order to form a cul de sac. The outer end is then stitched to the edges of the abdominal wound, which is closed up to the intestine. The minor details of the operation for the prevention of hæmorrhage or other casualties will be too obvious to require specification here. The advantage of Paschutin's fistula over that of Thiry's depends upon the fact that it is much longer, and that it is fixed by the short mesentery of the jejunum, which renders prolapse of the part impossible.

On account of greater convenience in collecting a large amount of digestive fluid, and of comparing experiments with different animals, and because the fistula is inapplicable to some animals, as to the young, for instance, Paschutin prepared water infusions of the intestinal mucous membrane in the following manner. Having bled an animal to death, he removed the intestines, and washed out all their contents by a stream of water admitted through the rectal extremity. As soon as the water came through clear, he grasped the intestine by its two ends,

and shook the contained water back and forth to disengage any particles still clinging to the walls. This was continued for about five minutes. He cautions against too long and too careful washing, as the active properties of the mucous membrane will be dissolved out also, as was the case with Wittich, who washed the rabbit's intestine for half an hour. The mucous membrane is then easily scraped from the muscular layers beneath, comminuted with shears, or rubbed up with ground glass, and mixed with three to six parts of water. After standing at the ordinary temperature from a quarter of an hour to two hours, it is filtered through linen, or through a tunnel containing ground glass, and then through paper. The fluid thus obtained is of a yellow color, alkaline reaction, and with an odor of the intestinal canal.

Paschutin does not state the mode of his experiments upon albuminoid bodies and fats, but gives, in minute detail, the processes which he adopted for testing the action of the above infusions upon starch. These processes are so complete and delicate that I desire to give them somewhat at length. His task was not merely to show that sugar appeared after starch and intestinal juice had been mixed and exposed to a certain temperature, but to prove that sugar was not due to microscopical organisms or the influence of the air, but was formed at the expense of the starch under the influence of the digestive fluid, and also that it was not the result of some change in the digestive fluid itself.

To demonstrate these points, he pours into three glasses (I., II., III.) equal amounts of the water infusions, about fifty centimetres, and heats glass I. for a short time at a temperature from 80° to 90° C. This temperature coagulates all the albumen, and, as will be seen later, destroys all diastatic virtues which the fluid may have possessed. To I. and II. he then adds equal amounts (twenty-five centimetres) of freshly prepared starch paste, and to glass III. an equal volume of water. A fourth glass receives, simply, a known amount of starch paste. Thus,

Glass I. contains intestinal juice (previously heated), 50 ccm. + starch paste, 25 ccm.

Glass II. contains intestinal juice (unheated), 50 ccm. + starch paste, 25 ccm.

Glass III. contains intestinal juice (unheated) 50 ccm. + water, 25 ccm.

Glass IV. contains only a certain amount of starch paste.

These glasses he then places in a water-bath, pendant through the openings of a floating disk, and keeps them at a temperature of 35° to 40° C. for a short time, and then interrogates them for their sugar contents. To this end he employs the following reactions:—

Moore's Reaction.—This test, as is well known, depends upon the fact that a colorless fluid, containing sugar in solution, by warming with a caustic alkali, will turn yellow, then red, brown, and, finally, black.

A. The play of color is more active as the degree of temperature to which the solution is subjected is higher.

B. If two portions of a sugar solution, equal in volume and concentration, be mixed with equal amounts of alkaline solutions of different degrees of density, a more active color-reaction consorts with the more concentrated alkaline solutions.

C. On the other hand, if the sugar solutions vary in concentration, and are mixed with equal amounts of one and the same alkaline solution, the reaction favors the higher per cent. sugar solutions.

D. If different amounts of a concentrated alkaline solution be added to equal volumes of a sugar solution, the color will be found to diminish with the larger amount of the alkali. The opposite effect takes place, however, if the alkaline solution be weak. (This latter statement is true only within certain limits.)

Hence, it follows from (C) that if equal volumes of similar fluids which contain different amounts of sugar be combined with similar amounts of an alkaline solution of one and the same concentration, and be then heated at one and the same temperature for the same length of time, we can quantitatively determine the amount of sugar contained in each fluid by comparing the rapidity with which the color-changes appear and follow each other.

As the value of this test depends upon the accurate comparison of depths of color and color-changes, it is obvious that the test glasses must be colorless, of the same diameter, and must possess the same ability to transmit heat. Accordingly, Paschutin took a dozen test-tubes, of medium size, and poured into each one an equal amount of sugar solution and of caustic soda solution, and chose those tubes in which the fluids stood at the same level. These tubes were then corked to prevent access of carbonic acid from the air, placed in the apertures of a wooden disk, and submitted in a water-bath to a temperature of 80° to 90° C. Only those tubes were approved in which the colors appeared and changed simultaneously. The water-bath should be made of glass, for convenience in observing the play of colors.

To determine the delicacy of Moore's reaction in a mixture composed of starch, a ferment and an alkaline hydrate, Paschutin prepared a compound consisting of a four per cent. solution of starch (1 part), a ten per cent. solution of caustic soda ($\frac{1}{2}$ part), and human saliva filtered and diluted ten times (1 part). As the alkaline hydrate was added to the starch before the ferment, no diastatic action could result from the contact of the two latter. From this mixture, he poured ten ccm. into each one of ten approved test tubes, and then added to each one, respectively, 0, 1, 2, 3, &c. drops of a sugar solution. (0.25 grammes of sugar to 100 ccm. of water; one drop $= \frac{1}{25}$ ccm.) The tubes were then well shaken, corked, and placed for three to five minutes in hot water (85° C.) until the colors were distinct. With care, he says, one may distinguish the color from one drop of the sugar solution. With two drops, the color is well defined; and with three drops it cannot escape the most careless observer. One drop of the above sugar solution, however, contains 0.0001 gramme of sugar, which, in relation to the whole amount in each tube (10 ccm.), equals 0.001 per cent, If, now, instead of a 0.25 per cent. solution of sugar, one employs a 0.1 per cent. solution, no difference from the above result can be distinguished. A one per cent. solution gives a scarcely traceable difference. It follows, therefore, that if ten ccm. of the mixture contain 0.01 gramme of sugar (0.1 per cent.), the smallest difference in the variation of the sugar contents which is distinguishable by Moore's test is equal to about 0.0004 gramme (0.004 per cent.) Generally, so long as the

sugar contents do not exceed 0.5 per cent. the color confines itself exclusively to the yellow tint.

Having thus illustrated the great delicacy of Moore's reaction, and having obtained a number of approved test tubes, Paschutin returns to the mixtures which he left floating in the water-bath (page 16). If diastatic action be possible under any of the conditions given in any of the four glasses, it must have taken place by this time. Accordingly, he removes the disk from the bath, and subjects II. and III. to a high temperature, to coagulate the albumen, and then filters them together with I., which was previously heated. This precaution is merely a matter of convenience, as the reaction shows no essential difference if the albumen is not removed, but requires much more time.

He next arranges a great number of approved tubes in four rows, supported by a wooden disk floating in ice cold water. Each row of tubes corresponds to one of the solutions above described, and into each tube is poured five ccm. of the mixture corresponding to its row. To each tube of the four rows is then added two ccm. of a six per cent. to ten per cent. solution of caustic soda. The tubes are then corked and transferred with the disk into a hot bath, where the color-changes can occur if sugar be present.

Besides Moore's reaction, Paschutin employed Trommer's test with Fehling's solution, and also the yeast fermentation test, but he decidedly preferred the first, on account of its superior delicacy.

By modifying the above experiment, so as to test the diastatic changes at varying intervals of time, Paschutin found that starch alone (IV.), subjected to the temperature of the body, will change into sugar spontaneously, but only after considerable time, rarely till after the lapse of a day. The normal infusion itself contains a feeble trace of sugar, which soon disappears on being warmed at 35°–40° C. On the other hand, the mixture of the normal infusion with starch (II.) gives a decided sugar reaction, which increases in intensity for five hours, and then gradually yields to an acid fermentation and the appearance of a precipitate of albumen. The phenomena in bottle I., wherein the infusion had been previously subjected to a high temperature, correspond to the appearances in bottle III., which contains merely the infusion and water, thereby proving that a high temperature is destructive to the ferment of intestinal juice.

From this testimony, it seems indubitable that sugar is formed at the expense of starch under the influence of an infusion of the intestinal mucous membrane, and in the above case was not due to any idiopathic changes, so to speak, in the fluids themselves, or to the influence of organisms introduced from the air. Paschutin adds, that the substitution of the natural secretion for the infusion causes no essential modification of the phenomena, and in comparison, he says, the ferment of the intestinal juice is about equal in strength to a weak solution of saliva. He observed that the intensity of the sugar reaction under the influence of one and the same diastatic fluid depended upon the concentration of the starch paste, upon its relative amount, and particularly upon the temperature in which the sugar formation occurred, and he attributes the negative results obtained by Thiry, Leube and Quincke to a lack of consideration of such points on their part.

Paschutin tabulates the results of his experiments as follows :—

A. The water infusion of the mucous membrane of the small intes-

tine of a dog, exposed for three or four hours to a temperature of 37° to 40° C., yields a voluminous precipitate of albumen, which remains unchanged up to the beginning of decomposition. Simultaneously with the appearance of the albumen, there occurs a decided diminution of the alkaline reaction of the infusion, which sometimes assumes even an acid reaction. Parallel with these phenomena, there disappears from the fluid that constituent which reduces copper oxide in the freshly prepared specimen. Previous boiling of the infusion does not entirely prevent the occurrence of the above phenomena, as, in place of the precipitate, a slight turbidity occurs. Fibrin of the blood and other albuminous materials are not converted into peptones by the infusion. Fat is not decomposed, but only imperfectly emulsified. All the above remarks apply, also, to the infusions of the colon. The natural intestinal secretion gives negative results as regards the digestion of fats, various albuminoid substances, and especially obscure results in regard to the digestion of fibrin.

B. The infusion of the mucous membrane of the small intestine converts starch into sugar. The infusions of other mucous membranes act in an analogous manner, the only difference being quantitative. Diastatic properties are found in the following mucous membranes, in the order of arrangement: in the membrane of the small intestine, urinary bladder, gall bladder, cæcum, colon, rectum and stomach. The œsophagus yields a slimy infusion which has no diastatic power. The secretion from Thiry's fistula in the small intestine changes starch into sugar. No secretion has yet been obtained from a fistula in the colon.

C. Among the infusions of the above mucous membranes, only that of the small intestine (from the pylorus to the valvula Bauhini) contains a ferment which changes cane sugar into grape sugar. This peculiarity, however, is not common to all animals; it was observed in the dog, cat, mouse and rabbit, but not in the ruminantia (he only examined the sheep and calf). The same is true of the natural juice of the intestines.

D. Those infusions which act as well upon starch as upon cane sugar do not contain one ferment possessed of this double virtue, but two distinct ferments, viz., (*a*) the starch ferment, and (*b*) the cane sugar ferment. These ferments may be obtained separately by the following process: After washing the small intestine of a dog, and removing the outer layer of muscle, fill it with water under a pressure of a column of water two metres high. The fluid (I.) which filters through under this pressure contains a rich amount of ferment *(a)*, with scarcely a trace of *(b)*. The residue (II.) remaining in the intestine contains ferment *(b)*. To relieve fluid I. of all traces of *(b)*, it should be subjected to a temperature of 37°–40° Centigrade for an hour. The albumen precipitate thus formed carries down with it all of ferment *(b)*; or, again, fluid I. may be refiltered after thoroughly washing out the intestine. If, in the second filtering, too great pressure be avoided and the fluid be allowed to pass through the membranes drop by drop, the filtrate will not contain the smallest trace of *(b)*. Fluid II. may be freed from all traces of *(a)* by further addition of water and filtering.

The infusion of the mucous membrane may be similarly filtered through a previously washed intestine, but as it is rich in albumen, it

requires more pressure, which is a great obstacle to the complete separation of the ferments.

E. A temperature above 40° C. acts destructively upon a solution of an animal ferment which changes starch into grape sugar. A temperature not exceeding 40° C. is entirely harmless to the same. This destructive action of the temperature is modified in its effects by the following conditions, viz., by the degree of the temperature, the duration of its influence and the concentration of the ferment solution. The higher the temperature, the longer its action; and the diluter the ferment solution, so much the more is the damage.

F. If starch paste be exposed to the air, there appears in it a something which will reduce copper oxide. The presence of this reducing agent can sometimes be detected after the lapse of a few hours, but ordinarily not till after two or three days.

These results of Paschutin are practically confirmed by Bernard, who, if not always correct, is always bold in his opinions. As recently as 1856, Bernard maintained that none of the tissues or secretions of the body contained a ferment in the fresh condition. Only in proportion as they had undergone decomposition, could they be said to act as ferments; and hence those secretions which were the most active were said to be the first to yield to decomposition. With equal force and enthusiasm, he now declares that the intestinal juice contributes exclusively to the digestion of the hydro-carbons, and particularly of cane sugar. Its action upon cane sugar, he says, is due to an albuminoid ferment, which it contains, and which he calls "*ferment inversif.*" Amylaceous bodies are digested, he says, very feebly; and of the albuminoid group, fibrin is the only one attacked.

This brings me to the consideration of a number of experiments of my own, which were completed before I knew anything about the results obtained by other men, so that my observations and conclusions, so far as they go, are entirely unprejudiced. I employed Thiry's method of establishing a fistula.

The dog which was associated with me in these experiments was a small mongrel female, in whom the bull-dog element seemed predominant. She was fastened upon her back, and etherized, and then operated on for the fistula. No food was allowed her for a few days subsequent to the operation. Then she was restricted to bread and milk for a few days longer, and finally returned to a regular dog diet. At first, she showed considerable general disturbance, and became quite emaciated; but she gradually regained her flesh and spirits until, in a few weeks, she was as plump and playful as before the operation.

This was in November of 1872; but no digestive experiments were undertaken until the following February, when the external meatus of the fistula was found sufficiently large to admit a medium-sized elastic catheter. I cut off about four inches of the end of a rubber catheter, punched numerous eyelets in it, and then attached it to a short glass tube, which tube was passed through a piece of cork. The cork served two purposes. It prevented the catheter from slipping into the fistula and supported a large test tube for the collection of the secretion which might flow out from the fistula. A slit was cut in the side of the cork to allow the escape of air from the tube as the secretion entered, while a string, attached to the cork and passed around the dog's body, supported the whole apparatus in place. To prevent the dog

from roaming, she was stationed under a horizontal pole, from which she was suspended by ropes passed round her hips and shoulders; only the ropes were so adjusted that they allowed her to rest on her feet, and confined her only when she attempted to move.

Like Thiry, I found that the fistula secreted but little unless irritated, though it was occasionally filled with a yellow, butter-like mass of secretion, from which the water had been reäbsorbed. This plug of inspissated *débris* was the source of great inconvenience, as it both prevented the introduction of the catheter, and plugged up the eyelets, so that no secretion could flow out. By first introducing a glass probe, I sometimes excited sufficient secretion to lubricate the mass, which could then be expelled by external manipulation. Care was necessary in these attempts not to injure the parts, else the integrity of the secretion would be impaired by admixture with blood.

The irritation of the mere presence of the catheter in the fistula was the only stimulant employed for exciting the secretion, and, therefore, I never got a great amount at any one time. The first time the catheter was introduced, I obtained only five drops of the fluid in an hour, which was the smallest amount I ever procured. As the dog and I became better acquainted, she responded more liberally, and once yielded me thirty drops in an hour.

One day, during my experiments, the dog was thoroughly frightened by falling from the table on which she stood, and by my efforts at recapturing her. During the next fifteen minutes, the fistula secreted only one drop, and at the end of half an hour, I was able to collect only three drops. Previously to the fall, she had been secreting at the rate of 14.8 drops per hour. The fact that the digestive processes are so often aborted by mental emotions led me to think that the nervous excitement of the dog consequent upon her fall might have lessened the action of the glands. It is also possible that in the struggle the fistula became misplaced in some way, so that the secretion could not flow as readily as before.

My digesting experiments were conducted as follows: Choosing four glass stoppered bottles, I added to I. twenty-five ccm. of distilled water and ten drops of intestinal juice. Bottle II. received an equal amount of water. Into III., I poured twenty-five ccm. of a hydrochloric acid solution (0.2 per cent.), and ten drops of intestinal juice; and into IV., I poured the same amount of the acid solution without the juice. To each of the bottles I added a few flakes of fibrin and then placed them in a water bath, which was maintained at a temperature of 36°–40° C. by a Bunsen thermo-regulator. To recapitulate:—

Bottle I. contained distilled water, 25 ccm., + fibrin + intestinal juice ten drops.

Bottle II. contained distilled water, 25 ccm., + fibrin.

Bottle III. contained acid solution (0.2 per cent.), + fibrin + intestinal juice 10 drops.

Bottle IV. contained, acid solution (0.2 per cent.), + fibrin.

The fibrin in bottles I., III. and IV. became softened and swollen in much less than an hour, and in the course of twenty-four hours was often entirely broken up, leaving only a turbidity of the fluid, or a slight sediment. As a rule, the fibrin in bottle III. was apparently more affected than in I. or IV. On the other hand, the fibrin in bot-

tle II. appeared to remain unchanged after a delay of a day in the bath.

Having noted the gross appearances, I removed the bottles from the bath and filtered them. Each one was then boiled with nitric acid until all precipitation of albumen ceased, and then they were filtered again. To the final filtrate, I added equal amounts of ammonia. The nitric acid gave a slight yellow tinge to the fluids in I., III. and IV.; and this color was invariably deepened on the addition of the ammonia, proving thereby the presence of peptones. The reaction in IV. compared very nearly to that in I., though they both were exceeded in depth of color by the reaction in III. Bottle II., which contained merely fibrin and water, gave negative results in every instance. These experiments were repeated many times, and always with the same results.

I am aware that my experiments are liable to one objection, in that I did not digest the intestinal juice and water without fibrin to see if the presence of the peptones might not be due to some change in the secretion itself. I think this objection can be met, however, by the record of the gross appearance of the fibrin subjected to only ten drops of the juice, and that soaked merely in water. The former softened, swelled up and dissolved, while the latter was apparently unchanged, even after twenty-four hours. I made repeated tests of solutions of distilled water (25 ccm.) and intestinal juice (10 drops), and also of the acid solution (25 ccm.) and intestinal juice (10 drops). These mixtures, freshly prepared, gave an exceedingly faint yellow color as the result of the test above described; but the color was in no wise comparable to that obtained after the digestion of the fibrin. The fibrin which I employed was obtained by bleeding a dog to death, whipping the blood as it escaped and filtering it through a cloth. It was then washed perfectly clean by running water, and preserved for use in glycerine. On removal from the glycerine, it was squeezed thoroughly, and then washed in distilled water.

On substituting egg for fibrin in the four bottles above mentioned, my results were not so satisfactory. The egg was boiled, and then cut into thin slices through the white part. A few slices were added to each bottle. The egg in bottle II. remained unaffected, even after twenty-one hours, but, on testing the solution for peptones, I obtained, in every experiment, a faint yellow color, showing that peptones were present. This color, however, was eclipsed by that in I., III. and IV. I am unable to explain the presence of peptones in bottle II., unless it be that, during the boiling of the egg, the albumen was affected by some of its own chemical constituents, and that thus the peptones were formed.

Only one experiment was made with regard to the diastatic action of the intestinal juice. A thin, starch paste was prepared, and placed in two bottles (25 ccm. in each). To the first was added fourteen drops of intestinal juice, and then the two were placed in the bath, as in previous experiments. After a short time, all the starch in the controller (II.) had settled to the bottom, leaving the fluids clear above. In bottle I., however, the starch did not form so dense a precipitate, and the fluid was somewhat turbid. On adding Fehling's solution to the controller, and boiling, no sugar reaction appeared,

though the same treatment of bottle I. gave decided evidence of the presence of sugar.

The conclusions which I derive from my experiments, therefore, are, that the intestinal juice converts starch into sugar. Its action upon boiled white of egg is doubtful. Whether alkaline or acidified, it exerts a solvent influence upon fibrin. Thiry declared that the intestinal juice when acidified ceased to act upon fibrin. I found that its action was increased by combining it with a 0.2 per cent. solution of hydrochloric acid. Lastly, I observed that the fibrin was converted into peptones by the action of hydrochloric acid alone.

A *post-mortem* examination of the condition of the dog's abdomen was made on Oct. 10, 1873, which was nearly a year after the operation. The fistula had not been meddled with for several months previous, and was consequently full of the inspissated yellow *débris* before mentioned. This had a peculiar, doggy, musty smell, but no odor of decomposition.

On opening the abdomen, the mesentery was found adherent in every direction to loops of intestine, showing that quite extensive peritonitis had existed. The fistula itself was adherent to a neighboring piece of intestine, and was fourteen centimetres long. It was considerably atrophied, being four centimetres in circumference, while the smallest adjacent portion of the intestine was five and a half centimetres. Near the inner end of the loop, the main intestine was bent at right angles, and held in that position by adhesions. Above the angle, the intestine was distended eleven centimetres in circumference, and contained a hard lump, which proved to be bits of straw, sticks, and other indigestible materials, which could not pass through a slight constriction at that point. Careful inspection of the part detected only a faint trace of a cicatrix to mark the place from which the fistula had been excised. The cicatrix, such as it was, was situated forty-five centimetres above the ileo-cæcal valve, and one hundred and thirty-seven centimetres below the pylorus. On cutting open the intestine and the fistula, the mucous membrane of the latter was found to be of a somewhat deeper, red color, but no microscopical difference could be detected in the epithelium of the two.

Portions of the fistula and intestine were hardened in alcohol, and then carefully compared by microscopical sections. There was, apparently, no structural change in the fistula, except that it was atrophied. Lieberkühn's follicles were distinguishable throughout their entire length, but were much smaller, and more indistinct than they were in the intestine proper. It will be remembered, however, that this examination was made several months after my experiments, and that during those months the fistula had been plugged up with the secretion and undisturbed.

Thus far, I have described the results of observations made upon the small intestines mainly, and but a few words more will be necessary to state all that is known regarding *digestion in the large intestine.*

It was formerly supposed that the cæcum possessed special glands of an acid secretion, and served the function of a second stomach. The acidity of the contents of the different portions and appendages of the large intestine is now known, however, to be due to the acid fermentation of the chyme, inasmuch as the mucous membrane of the parts designated gives a very intense, alkaline reaction.

The secretion of the large intestine has never been collected by Thiry's method, though several attempts have been made. Frerichs, with his loop confined between two ligatures, obtained a fluid similar to that of the small intestine, and greater in amount. Bernard claims that the large intestine is merely the seat of physical and mechanical acts, or of chemical acts which are of no importance as regards the true digestive phenomena. This opinion conflicts somewhat with the observations of Paschutin, who says that separate infusions of the mucous membrane of the cæcum, colon and rectum converted starch into sugar, but did not affect cane sugar, albuminoids or fats.

Kühne quotes the saying that the *processus vermiformis* is good for nothing, except to hurry one to death when any chyme has unwontedly entered it. It is well supplied with Lieberkühn's follicles, however, and, therefore, in some animals, where the process is very long, it must contribute no inconsiderable amount of secretion to the cæcum. Funke tied a string around the upper part of the long appendix cæci of the rabbit without injury to the vessels, and, after two to four hours, examined the secretion. It was slightly ropy, turbid from presence of cylinder epithelium and the products of digestion, and had an intense, alkaline reaction. It changed starch into sugar, and excited acid fermentation, but had no effect upon raw albumen or flesh, either within or without the body.

Funke's results are open to criticism, however, as the fluids which he obtained evidently contained other matters than the pure secretion of the part. Accepting Paschutin's opinions as the most reliable, we may conclude that the secretion of Lieberkühn's follicles in the large intestine differs from that of the small intestine in amount, and in the fact that it does not convert cane into grape sugar. Otherwise, the two secretions are similar in quality.

The following table contains a digest of the experiments thus far described :—

Action of Intestinal Juice on

	ALBUMINOIDS.	STARCH.	FATS.	CANE SUGAR.	GRAPE SUGAR.
Busch.	Protein bodies are dissolved with the appearance of putrescence and the odor of ammonia.	Acts more energetically upon starch than upon protein bodies.	Unaffected; not absorbed unless mixed with bile.	Unaffected.	
Thiry.	Fibrin is crumbled in the normal secretion; this does not occur if the juice be neutralized or acidified. Coagulated white of egg and red muscle are unaffected.	Starch is not converted into sugar.	Unaffected.	No change after hours of digestion.	Intestinal juice has no fermentative influence.
Leube.	Fibrin is crumbled; other albuminoids are unchanged.	Unaffected.		Cane sugar is changed to grape sugar.	Lactic and butyric fermentation occurs as the result of presence of vibriones.
Quincke.	Fibrin is dissolved occasionally; raw or cooked flesh and coagulated white of egg are unaffected.	Starch is changed to sugar after a long time.	Unaffected.		Converts sugar into lactic acid after a long time (12 to 24 hours).
Schiff.	Albumen, fresh casein, cooked or fresh muscle are dissolved in the secretion of the duodenum.	Action on starch almost as energetic as that of pancreatic juice.	Oils are emulsified.		
Wittich.	Fibrin is not digested.	Energetic diastatic action, in one instance.			
Paschutin.	Fibrin and other albuminoids are unaffected by water infusions. Action of normal secretion is especially doubtful on fibrin.	Starch is converted into sugar.	Fats are imperfectly emulsified.	Cane sugar is changed into grape sugar by a ferment found only in the small intestines.	Acid fermentation occurs after a few hours.
Bernard.	Fibrin is the only albuminoid substance attacked.	Acts very feebly on starch.		Chief function of secretion of small intestine is to digest cane sugar; secretion of large intestine is impotent.	
Garland.	Fibrin is crumbled and converted into peptones, whether the secretion be alkaline or acid. Digestion of coagulated white of egg is doubtful Fibrin is digested by a 0·2 per cent. HCl solution.	Starch is changed into sugar.			

It will be seen from the preceding table that nearly all the observers agree that fibrin is digested by the intestinal juice, but that all other albuminoid materials are unaffected by that secretion. Two of them declare that starch is not changed to sugar, while the remainder, with more or less vehemence, assert the opposite opinion. The testimony in regard to fats is entirely negative, except that they are sometimes emulsified.

It seems pretty certain that the secretion of the small intestines converts cane sugar into grape sugar, and Bernard claims that this is the chief function of that fluid. Only four venture to testify to acid fermentation, and, of these, three say that the secretion does produce it.

Fortunately, we have further testimony regarding fermentation in the observations of Planer upon the causes of flatulence. Magendie stated that the gases in the alimentary canal were secreted by the mucous membrane. Planer, however, observed that in normal digestion, gases occurred only exceptionally in the stomach, but were common in the intestines. This led him to a series of experiments, by which he proved that the gases are due to fermentation of the chyme, and that this fermentation is favored by alkaline substances, but is checked by acids. Moreover, the activity of the fermentation grows weaker as its own acid products increase, but is revived by the addition of any neutralizing agent. He concludes, therefore, that the immunity of the stomach from gases is due to the acidity of its secretions which prevents fermentation, while the intestinal secretion favors fermentation by its alkalinity.

He notes a fact of therapeutical interest, namely, that the addition of magnesia to the food increases the formation of gases in the intestines, and particularly of hydrogen gas, while the addition of acid hinders it. Sulphuretted hydrogen gas is found after a flesh diet, but not after vegetables. Oxygen does not occur at all. Hydrogen and nitrogen are common ; and coal gas was discovered once in man, but never in dogs.

It may be objected that the amount of digestive energy exhibited in the experiments described is altogether insignificant in comparison with the amount required for the disposal of a good dinner. It must be borne in mind, however, that these are qualitative experiments, merely, and give only the relative action of small amounts of the secretion, when kept in a quiescent condition in a water bath. For a fair quantitative estimate of the value of the intestinal juice, we must await a more definite approximation to the probable amount of the secretion, at the same time remembering, as Dr. Edes says of pepsin, that the results of artificial digestion cannot limit the activity of a secretion in an organ which absorbs the products formed, and which, for all we know, may be capable of rapidly returning to its interior the ferment which still retains its activity.

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